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THE INSECTS OF A LONDON BACK-GARDEN.—II.

By FRED. ENOCK, F.L.S., F.E.S.

IN all probability on the willows forming the background of our "thirty feet by seventeen feet" will be found several *larvæ* of the common puss moth, the eggs of which are generally laid singly on the upper surface of the leaves, reminding one of miniature macaroon biscuits. The baby caterpillar emerging from these eggs is velvety black, with two long whip-like tails which are telescopic, each containing a long, red, thread-like addition, which is rapidly shot out and whisked about from side to side whenever any ichneumon fly endeavours to come too near. Although these parasites are persistently whipped off, there comes a time of weakness of body when the grub is putting together a new suit of clothes, which are put on under the old ones! At such times the wary ichneumon takes the opportunity for settling on the back of the *larva*, and although it has an uncomfortable time it manages to pierce the double skin, and insert several of its eggs within the body of the unfortunate puss moth *larva*. With so many uninvited guests, literally eating the host out of home and body, what else can be expected than ruin to all hopes of ever changing to a lovely puss moth?

The noble caterpillars of the poplar and eyed hawk moths are frequent visitors to our gardens, as well as the more beautiful *Sphinx ligustri*—the privet hawk moth. It is the first sight of such "big game" as these moths that fires the youthful imagination; but so much has been written of these grand insects that I will only take one more example of *Lepidoptera* which I have found in my "thirty feet by seventeen feet."

Some years ago a large number of that ancient Roman dainty, the *Cossus* of Pliny—or, as we so well know it, the *larva* of the goat moth—appeared in the kitchen, much to the amazement of our domestic, who, from the power of example, did not put the grubs into the fire, but shovelled them up and submitted them to my notice. Some of them were three inches long and as thick as one's middle finger—the colour "yellowish flesh," with livid blotches on each segment. For more than a week we had daily visits from these "dainties," until at last I decided to examine a small willow growing in the garden of our next-door neighbour. I soon saw that the trunk, four inches diameter at the ground, was simply full of these *larvæ*, of all sizes from two to almost four inches in length. I broke the trunk down and up; the total number of these foul-smelling grubs taken from out of the trunk, together with those which had climbed and excavated the wall, was just one hundred and five!

FIG. 1.—Black Currant Gall Mite.

These *larvæ* do a great deal of damage to willow and oak trees, from the day of their birth, when the tiny grubs eat their way through the bark, under which they pass their childhood, until, increasing in size and age, they go deeper and deeper and completely riddle the largest trees with holes half an inch in diameter. Their relative, the wood leopard moth, is even more destructive, the *larvæ* boring up into the smaller branches. This is the cause of the death of many a tree in and around London. Years ago, thirty or forty ash trees, of about the same number of feet high, along the Hanley Road, N., were terribly infested, and on one day in July I "swarmed" up one of them and took twenty-two female wood leopard moths which had emerged that afternoon. Not having a box with me, though plenty of pins, I stuck all the specimens into my box hat and on my coat—much to the wonder of passers-by, who had doubts of my sanity. Such doubts are still shared by many even now, for where strange insects are accessible, there I feel it my duty to be; and, after all, Mrs. Grundy is quite welcome to her ideas.

FIG. 2.—Twig of Black Currant in April.

Now, we cannot live long in a London "back" without becoming aware of the music of the humming bee or bees—for various kinds favour us with their presence. The first

to appear is the mason bee (*Anthophora*), whose "hostile hum" is heard for a moment as it wheels over and then poises at the first opening crocus, sipping the nectar; then away it goes with a dash, but suddenly pulls up and settles. Note how it sits. It appears to touch the ground with the very tips of its twelve toes, each pair of legs being arranged so gracefully in a moment, the long hairs spreading out as though each one had been combed into position; and just when you are beginning to realize how wonderful and perfect an insect it is, another bee—a black one—passes,

FIG. 3.—Twigs of Black Currant, showing "Galls."

and in a moment the russet-brown sitter is up and away in hot pursuit of his mate. At "Happy Hampstead" is a colony of these bees, together with their parasites (*Melecta*). This parasite has a hoary face and blue-black thorax and body, each segment spangled with patches of intense silvery hairs—the tips of the leg-joints being similarly marked. The beauty of this bee is long remembered; so is its sting, which is long and sharp. A small piece of common washing soda is a useful addition to the stock in pocket of an entomologist, a quick rub with which soothes the pain of either nettle or the sting of a bee. The leaf-cutter bee is to be found in every garden, and may frequently be observed cutting out from the leaves of rose bushes and various shrubs, circular and oblong pieces with which to form the bottom and sides of its cells, which are to be found in old posts, under tiles, and between bricks from which the mortar has fallen away—though this bee has no difficulty in removing *London* mortar, aided by her powerful mandibles. Years ago I used to find a very interesting

FIG. 4.—Section of Gall showing predaceous Larva.

bee—*Anthidium*—visiting hollyhocks, first to strip off the woolly covering from the stems, which, when a bundle had been stolen, was carried to its burrow, and used for decorating the walls: then to rob the flowers of the nectar and pollen; during which pilfering fertilization of the flower takes place.

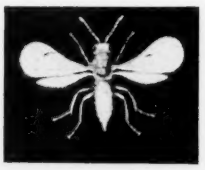

FIG. 5.—Destroyer of Gall Mite.

There is always a comical side to a London back-garden; for instance, when we find someone from the country endeavouring to grow black currants. The result is generally failure as regards the fruit. Another drawback to such praiseworthy attempts at horticulture is the appearance of that "pest," the black currant gall mite (Fig. 1), which has the hardihood to venture into a London "back." This mite, though but the four-hundredth part of an inch in length, has become so numerous in Great Britain that many of the black currant orchards in Kent have suffered so much that over fifty per cent. of the crop has been destroyed.

In form it is not unlike a cigar. Its habit is to ascend the currant trees, and work its way between the scales of a tiny bud, in which it lays an immense number of eggs, which soon hatch, the *larvæ* spreading all over the bush, and ultimately to every bush. Fig. 2 shows a small twig having one healthy shoot, as seen in April, when the delicate leaves are unfolding and the fruit buds are beginning to develop. At the tip and left side are distorted buds, having an altogether abnormal appearance, not unlike very minute cabbages; these are full of gall

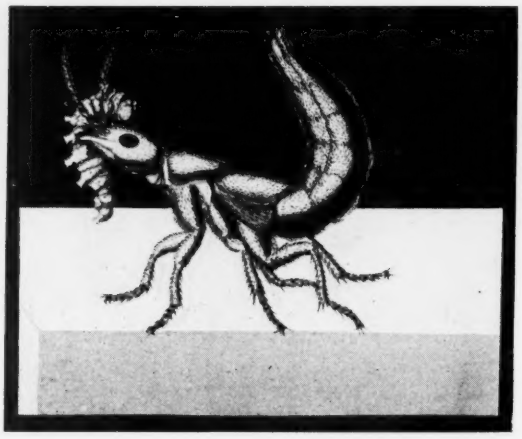

FIG. 6.—Devil's Coach-Horse Beetle taking a Meal.

mites. The lower "gall" is one of the previous year's growth—perhaps the original one, from whence all the damage emanated. Fig. 3 gives an idea of the appearance of an afflicted bush. This photograph I took in November, and anyone can see how few healthy buds (the sharply pointed ones) are to be found—the "galls" being in the majority.

Wishing to find "the blessing" (a parasite or predaceous insect), I carefully picked some hundreds of the "galls," putting them in a tin box. I had dissected about one hundred, by cutting them through the centre, before I came upon the object of my search. This was a small white maggot (Fig. 4) between the distorted leaves, feeding on and making short work of the mites. In three months

the flies bred from these *larvæ* began to make their appearance (Fig. 5). These are about one-thirty-second of an inch long, and of most exquisite beauty.

The only means for getting rid of this scourge of "galls" is by united action in the United Kingdom, but John Bull, as represented by the farmer, has his little peculiarities, and believes that digging up a currant tree and throwing it on a heap is quite sufficient to kill the mite. "Why, it has nothing to feed on," said one of the cheerful farmers. "Ah! but each mite has legs and the power to use them," I replied; "and they very soon transport themselves to new and distant climes." The one and only plan for their extermination is to carefully pick each "gall" from each bush (don't drop one), and then burn them.

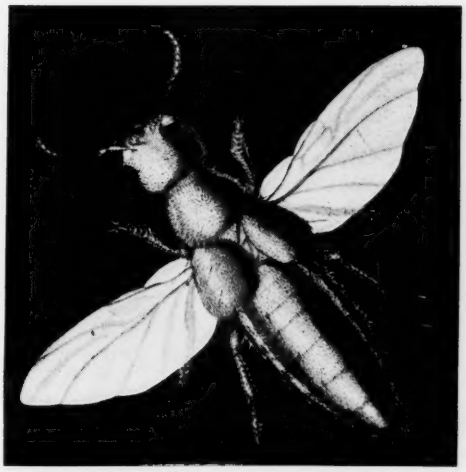

FIG. 7.—Devil's Coach-Horse Beetle.

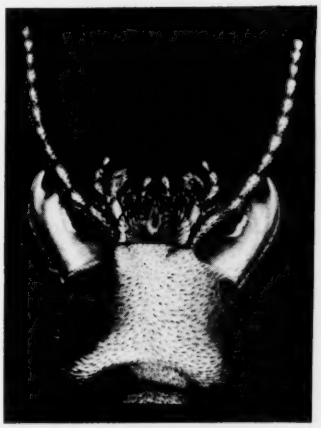

FIG. 8.—Mouth Organs of Devil's Coach-Horse Beetle.

How many a gardener has turned away in fright at the sight of the devil's coach-horse beetle (*Ocypus olens*), (Fig. 6). In October this devil's coach-horse is very plentiful in our gardens. It is the largest of this peculiar shape, being over an inch long. When no one appears to be looking at it, it puts on rather a grovelling appearance, creeping into very narrow cracks and preferring damp stones; but directly it sees anyone—and it is generally the most observant—with a jerk its head is raised, and with another its tail. Sometimes one jerk suffices for head and tail, but at others it is too much for its equilibrium, and the decidedly conceited and over-confident creature upsets with its own uppishness. I have had hard work to persuade my friends and acquaintances that this beetle is a true friend of every gardener. I have watched it at its beneficial work at all hours of the day and night, and never once have I caught it doing the slightest harm. A favourite resort of these creatures is the railway embankment gardens at Upper Holloway Station. Many

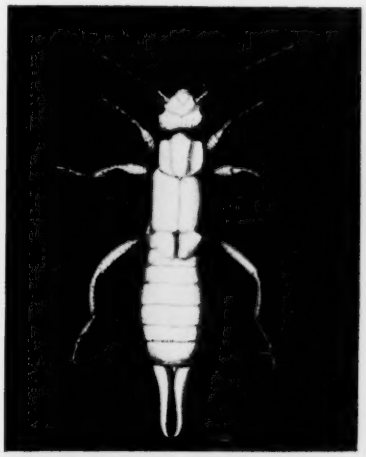

FIG. 9.—Earwig. Wings closed.

times have I watched the devil's coach-horse foraging among and under the cabbage leaves for green caterpillars, and so fond are they of this morsel that they will expose themselves to great risks in obtaining it. One morning I noticed one at the edge of the brickwork examining a cabbage leaf on the under side of which was a large caterpillar, which the devil's coach-horse seized with a jerk of its own head and tail (Fig. 6), and this, in conjunction with the jerk which the caterpillar gave on being seized, upset

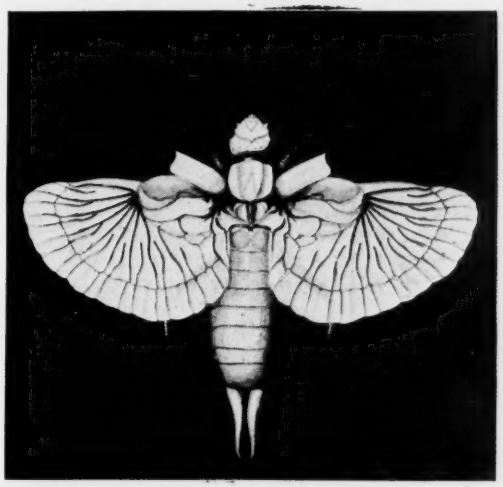

FIG. 10.—Earwig. Wings expanded.

the pair and they fell a distance of nearly three feet on to the asphalte below—but the beetle kept hold. I picked them both up and put them into a pill-box. On reaching home half an hour after I opened the box, and the devil's coach-horse was there, but the caterpillar was not; it had been eaten like many another of its kind. At night these

creatures make short flights. In wheatfields the devil's coach-horse beetles are very plentiful, as most farmers know who notice such things. They lay their eggs in the ground, hollowing out a cavity for the purpose, and the *larvæ* keep under ground, but come up during the night; they are exceedingly fond of worms. Fig. 7 represents the creature in flight, the wings being very beautiful and large. Many ordinary observers would never imagine or believe it possible for such wings to be folded up and put away underneath the small wing cases. When the wings are more than half folded, the ends are tucked in by the spines of the tail, which is turned up for this purpose. Many insects use their abdomen to help in this delicate operation. Fig. 8 shows the mouth organs of the devil's coach-horse beetle; the powerful mandibles and more delicate and exquisitely beautiful "brushes and combs" which are kept so marvellously clean.

To some, a rubbish heap may not appear a pleasant place in and upon which to search for insects, but one of the greatest marvels of all minute insects is found in such a place. Underneath an old half-rotten board, soaking with moisture—one that has been on the rubbish heap for weeks—is a perfect Elysium for an insect hunter who wants to find something wonderful. Under such a board I have found endless prizes: several species of those curious *Chelifers*, or pseudo-scorpions—small creatures with crab-like claws and crab-like movements, for, touched on the head, they shoot backwards, and are very difficult to get into a phial.

Many species of *Podura*, or "spring-tails," are very common; and *Tomocerus plumbeus*, looking like a little atom

FIG. 11.—Earwig. Wings half closed.

of polished blacklead, and the still smaller and more beautiful *Seira Buskii*, are to be found, and occasionally the rarer *Lepidocyrtus curvicollis*, whose scales are highly prized by microscopists for testing their objectives.

The greatest prize of the rubbish heap is an almost microscopic beetle—*Trichopteryx atomaria* by name. It is about one-thirty-second of an inch in length, of the ordinary beetle form, with hard wing cases; but underneath these horny coverings are the most marvellously formed wings which it is possible to conceive. The base, or peduncle, is a mere bristle, which gently widens into somewhat of a paddle shape. From each side there spring long hairs packed close together, then a small space where they are not so thick, another paddle which is also fringed with still longer hairs, which radiate from the tip in the most exact order—and yet this complicated structure is folded up in four turns! Every hair is so arranged that not one is broken or displaced—it is a wing that fairly fascinates one. And this creature is found on a rubbish heap!

Is any garden ever free from earwigs? I am afraid not; but I am equally sure that not one out of a thousand gardeners would say a good word for this destructive insect. The name should be "earwing," from the shape of the wing, which is so much like the human ear—but how many people even know that an earwig has wings? Let us look at Fig. 9, which represents them closed, and

FIG. 12.—Earwig. Wings three-quarters closed.

then at the same insect with its wings wide open (Fig. 10), and I don't think I am wrong in singing the praises of this most delicate structure, perfect in form and method of folding up. Figs. 11 and 12 will give some idea of how this pleating is arranged, and how the tail is turned up and gives the finishing touches—or pushes to the ends of the wings. I have watched the small earwig, *Labia minor* (which flies in the sunshine), folding and unfolding its wings, and, with its forceps, so manipulating the wings that they seem to vanish as by magic and are never torn.

In conclusion of my somewhat incomplete account of "The Insects of a London Back-Garden," I feel I must say a kind word for the much-abused earwig, which, besides eating buds of chrysanthemums, phloxes, and all else, also eats vast numbers of eggs of *Lepidoptera*.

It is of its maternal affection for its young, however, that I would speak. After carefully excavating a cavity in the earth, it lays a number of whitish eggs, and "sits" upon them until hatched, and then broods over its brood of milk-white young with the utmost concern. Should the rough hand of a gardener upset the little family, it searches for the eggs or little ones with the greatest solicitude, and manages to recover all it can, and convey them to a place of safety.

The insects of a London back-garden will always repay careful study; and if flowers will not grow, insects do, and of endless variety of form and structure. There are insect treasures to be found under any old musty board, an odd brick end, or a heap of leaves. The seeker after such need never be idle in a London back-garden.

BIRD-SONGS IN SUMMER.

By CHARLES A. WITCHELL.

AT the end of spring most song-birds cease from singing, and those which continue in song generally omit certain accustomed notes from their strains. The chaffinch does not complete his familiar phrase; tree pipit and lark fly less often while singing. But the whitethroat indulges in a jerky song-flight almost as much as usual, and the buntings are as persistent in their monotonous efforts as at any time in the spring. The swallow gives forth a seemingly light-hearted strain which is equally general and unvaried (except in duration) in the species. It differs from many other songs in that it seems not to express any pugnacious instinct. In the summer months three or four male swallows will often be singing from the same perch with as much enthusiasm as though each was beside his mate. In this species, even more than in most others, the dawn induces the most frequent and prolonged utterance of the strain. The sedge warbler, lark, thrush, and other birds which imitate, are more mimetic than when first they sang this year.

The whitethroat, though not generally regarded as a mimic, has now certainly become a proficient reproducer of the cries of other species; but in this feature individuals differ, some preferring one model, some another, for imitation. In July its repetitions of the *fink* of the chaffinch are sometimes exactly like the original, and were they not uttered in a hurried song they would be difficult to identify as the notes of a warbler. Like the robin, also, the whitethroat will repeat the double alarm-cry of the swallow, but with a degree of accuracy varying in different individuals, though the seeming model is often copied exactly.

On the 18th of July last, in the fields near Eltham, the note in question was uttered loudly, and was rapidly repeated, at some little distance behind me, apparently from the other side of a small meadow. I turned hastily, expecting to enjoy the welcome sight of a hawk, which enemy of the swallow is always announced in the double cry. But there was no hawk—not even a swallow—near: only a whitethroat singing his boisterous song while passing in jerky flight along the line of the opposite hedge. The bird commenced each strain with five or six repetitions of the cry, with exactly the tone and accent of an angry swallow. A minute later the whitethroat came across the field, singing all the while, and passed directly overhead into a thicket; and when not more than fifteen feet above me it repeated the imitation, with the same accuracy as before.

July is comparatively a silent month in birdland; yet it is one in which the cries of birds are of the most importance to a naturalist, for now the alarms and call-notes—often typically generic sounds—are uttered with the greatest vehemence, since they are uttered to or for the young, and therefore express intense emotions. The whitethroat's sharp *chick chick*, very rapidly repeated, may be heard from every hedge; and the young will be noticed uttering the same cry as an urgent call to their parents. The garden warbler will be observed uttering a softer *shack shack* to its fledglings; the blackcap has a hard *tack tack;* and the croak of the nightingale is sometimes spread out, as it were, into disconnected ticking sounds resembling the above-mentioned alarm of the whitethroat, but with a more metallic timbre. There is a "family resemblance" between these cries, and it may be further traced in some allies of the birds which produce them.

Young starlings still complain with a hoarse *cah* of the same character as the alarm-note which their parents have so often uttered near the nest. The young missel-thrush has the rattling cry with which its parents rated their enemies—the jay and the sparrowhawk. Young nightingales give no sign of having received vocal impressions which will repeat in another generation the unrivalled music of the species; they croak harshly. Young chaffinches will be heard calling *chirry*, sometimes with tone so like that of the young house sparrow that the bird cannot be identified by its note alone. In short, most of the young birds may now be heard repeating the alarm-cries and the call-notes of their parents with never a song-note—a circumstance proving that the former sounds are the first to be acquired, and indicating that they are of the most value as connecting species in a generic chain.

The young of the great titmouse may now be heard repeating a cry which is never uttered by the parent—a sound suggesting the syllable *kle*, and more like a call-note of the common butcher-bird than that of any tit, except, perhaps, a long cry of alarm given by the marsh tit. It is curious that this *quasi* predaceous tit should inherit a tone similar to that of the predaceous shrike. A somewhat analogous instance is the peeting cry of the young cygnet, like that of a duckling, no such note being given by the adult swan.

It has often been said that August is the most silent month with song-birds; but very early in that month the town-bred starling returns to his favourite housetop, and the robin quits a woodland home in favour of a farm homestead or a suburban garden. The willow wren may be heard till the middle of the month, singing, like the chiffchaff, most often in the earliest hours of sunshine.

The starling and robin do not now sing in exactly the same way as in spring. The starling generally omits from his strain those toneless squeals (love call-notes) which concluded most of his phrases in spring; and their absence at this season suggests that the bird's pleasure in singing is not dependent on erotic emotion: indeed, since the starling's song is continued practically throughout the year, this emotion cannot greatly influence it.

In August and September the robin, on the other hand, has the habit of uttering his call-squeak in a tone which—so far as memory enables one to judge—is practically identical with that of the springtime call to mate and young; and (what is the more interesting) the sound is not only given once at one time, but it is often repeated several times in succession at the commencement of a song. Also, the note is at this time often associated with the long, high, distress-note which was uttered so frequently when the nest or the young were in peril. This association of the two cries occurs most commonly at the beginning of very brief songs, consisting of only a few notes—which are therefore the more suggestive of the nature of the original songs of the species. Singing of this elementary character may be well observed on quiet autumnal days; but it is most noticeable at dawn on a foggy morning. On this occasion the robin always gives the squeak for a minute or two before singing.

In most song-birds the variations in tone and musical pitch occur towards the close rather than at the beginning of the song, and in allied species the first parts of the songs have most resemblance to common types. The frequent utterance of call-notes in the simplest songs of the robin is, therefore, important, and especially so because those notes are represented by similar tones in some of the robin's near relatives. The scientific value of these similarities derives weight from the obvious fact that many birds, when attempting to sing, lack the art to advance

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beyond a mere repetition of a call-note; nor is it lessened by the wonderful retentive instinct which results in an adherence to particular cries or modes of singing throughout wide areas.

The elementary songs of the robin, just described, suggest that in a former age the strains of the bird or of its progenitor consisted of simple squeaks, as do the present songs of the spotted flycatcher. The remoteness of that period is in a measure proved by the generality of the ordinary style of song in the species, for the robin does not inherit any part of its song, but learns its language from its parents; and, therefore, the character of its well-known strain, developed partly by the occasional association and interchange of some of the individuals from different localities, must have occupied an incalculable period in its elaboration. Probably the mimetic faculty, which restricts the vocabulary of a young artificially reared robin to the cries of its foster parents, has ceaselessly operated to determine the tones of the species. But this theory is difficult to prove.

Early in September, in addition to the robin, starling, and wren, the chiffchaff may occasionally be heard. But more interesting at this time are the initial efforts at vocalization as occurring in young birds of the year. The young robin, with frequent rattling alarm and call-squeak; the hedge sparrow, repeating its squeak three or four times in rapid succession; the titmice, beginning to extend their vocal range; and young blackbirds, just learning to enunciate the well-known alarm of the species by repeating a clicking cry: these, and many more, are deeply interesting.

From the thickets a little whistled note tells where chiffchaffs and willow wrens are restlessly flitting and seeking insect prey, while they pass on from tree to tree and from wood to wood, taking a long farewell of their northern home. Their half-plaintive cries, breaking the autumnal silence, are in harmony with the other signs of the wane of summer; and on open land the call-notes of pipits, often repeated, tell the same story of departure.

In the garden the male house sparrow no more hops around his mate (or that of another sparrow), nor seeks to attract her attention and her attack; there is no noisy "combat" of sparrows; but out in the fields a cloud of the noxious vermin settles like a blight on the harvest, and there is now never a hawk to rid us of the pest. One cry is especially to be heard from these flocks. It is a very short cry, sounding like *whee* or *wheeu*. Earlier in the year this call was addressed to the young when they were being led away from danger, and now it may be similarly employed for the advantage of the flock. It is very noticeable, and is doubtless observed by other species, since it is often reproduced in the spring songs of lark and thrush.

JUBILEE HONOURS.

IN the long list of distinguished persons whom the Queen has been graciously pleased to honour on the completion of the sixtieth year of Her Majesty's reign, there is, we are glad to note, a sprinkling of some of the foremost men of science. Prof. Crookes, F.R.S., the discoverer of thallium, and Dr. W. R. Gowers, F.R.S., are among the new knights; Dr. Edward Frankland, F.R.S., Dr. William Huggins, F.R.S., and Prof. Joseph Norman Lockyer, F.R.S., have each been raised to the dignity of Knight Commander of the Bath; while William Henry Mahoney Christie, F.R.S., the Astronomer Royal, is among the C.B.'s. All the scientific world knows the merits of these men, and will doubtless join us in offering a word of congratulation for the success which has attended their labours in the field of science.

(*Concluding Article.*)

THE THRESHOLD OF A NEW ERA.

THE story of scientific enterprise during the last six decades is, as we have seen, full of interest, significance, and encouragement; and the measure of prosperity that has already been attained through science as a handmaid to the arts and industries (in spite of the difficulties within and the obstructions without) suggests greater possibilities which only the initiated can fully appreciate—possibilities immeasurably greater than anything that has hitherto been believed to be possible. Equipped as we now are in all the panoply of modern civilization, it was but yesterday, so to speak, that man put on the badge which clearly distinguishes him from his ancestors of a thousand years ago.

So far, the progress of science and its applications to the arts and industries, the opening of shorter avenues to trade, the increase of labour-saving machinery, the extension of railways, the synthesis of commercial products, etc., all these and similar advances which have revolutionized the world during the present century, increased luxury, and built up many great fortunes, present very different aspects to leading thinkers. Elevating though these things be in their nature, there are those who think that material progress does not merely fail to relieve poverty—it actually produces it. The new forces evolved from increase of knowledge are considered to act, in a sense, like a cutting plane which passes through the centre of society, elevating the one part and depressing the other—sharpens the contrast and widens the gulf.

Mr. Frederic Harrison says: "Our way seems the way to succeed, but we are not so infatuated with its advantages as not sometimes to suspect that there are other and less strenuous ways, whereby people who do not get on so fast as we may have more fun on the road." Progress to the many is a consolation for all the ills of life, and commends itself to the perceptions of the great masses of men.

To rightly estimate the advantages received from scientific progress, the condition of the people as a whole should be considered as compared with bygone generations; the keener sufferings in individual cases, bad as they are, would then seem less painful proportionally. But even as the tares and wheat spring up together, so we must always expect the counteracting complement of misery side by side with the richer endowments of nature.

Having lightly passed in review the achievements of the Victorian era, the question which concerns us now is—What further aid can we hope for from science? Are her resources drained? Have we already advanced into the full blaze of day, or are we only in the dim morning twilight—the dawn of a still brighter era?

Prof. Silvanus Thompson says: "There is no finality in science. The universe around us is not only not empty

is not only not dark, but is, on the contrary, absolutely palpitating with light, though there be light which our eyes may never see, and sounds which our ears may never hear. But science has not yet pronounced its last word on the hearing of that which is inaudible, and the seeing of that which is invisible." Finality, indeed! When you put on the armour of science you begin a warfare in which the individual enemy has the tantalizing knack of resolving itself into a plurality of foes; you feel as if you were walking out from a gently sloping beach into the sea, sometimes sinking suddenly over head in holes you didn't expect to find, and finally you find yourself floundering hopelessly in the unfathomable depths of the unknown.

Prof. Lockyer, referring to the unexplored domains of science, was once overheard to say: "Ah, my friend, science is not yet born; it is only conceived."

It is true that man has arrogated to himself the sovereign epithet, "Lord of Creation," and with some claim to the distinction; but from the remotest antiquity, through all the vistas of the ages up to the present time, the birds and insects and other denizens of the air have been, as it were, trying to teach us to fly. We have at last fully realized the fact that our position in the cosmos is fixed—our migrations limited to the skin of the planet on which we live and to a thin film of air which surrounds it. Habit has not dulled the edge of wonder, and we may live to see air ships a common sight. Prof. Langley says: "A flying machine, so long a type for ridicule, has really flown; it has demonstrated its practicability in the only satisfactory way—by actually flying, and by doing this again and again under conditions which leave no doubt. . . . The world, indeed, will be supine if it do not realize that a new possibility has come to it, and that the great universal highway overhead is now soon to be opened."

Our obligations to the old astronomy find their expression in the navigation of the seas, the calculation of the tides, and the daily regulation of time. What of the new astronomy? Can we derive material assistance from her in the routine of daily life? Dr. Huggins happily elucidates this point in the following words: "Her sphere lies outside the earth. Is she less fair? Shall we pay her less court because it is to mental culture in its highest form, to our purely intellectual joys, that she contributes? For surely in no part of nature are the noblest and most profound conceptions of the human spirit more directly called forth than in the study of the heavens and the host thereof." What has been achieved, in fact, does in reality supply us with more leverage—is in effect an accession of strength, an acceleration of our forward movement, the momentum of which will enable us all the more readily to penetrate through opposing forces, gather in with facility the harvests from ever-widening fields, raise more and more imposing and intellectual temples; and the darkness which now envelops many problems will be overpowered by the concentration of light from many scattered sources. Dr. Huggins, speaking of fifty years ago, says: "At the time any knowledge of the chemical nature and of the physics of the heavenly bodies was regarded as not only impossible of attainment by any methods of direct observation, but as, indeed, lying altogether outside the limitations imposed upon man by his senses, and by the fixity of his position upon the earth. It could never be, it was confidently thought, more than a matter of presumption whether even the matter of the sun, and much less that of the stars, was of the same nature as that of the earth, and the unceasing energy radiated from it due to such matter at a high temperature." Yet these impossibles have long since been subordinated to laboratory routine; the prism—more potent than "Agrippa's magic lens—unlocked the door behind which had lain the unknown mystery of the heavenly bodies.

The microscope as an optical instrument has advanced incomparably during the last twenty years. As Dr. Dallinger states, this has been dependent upon advances of a structural character, leading to a close approximation to perfect corrections in its spherical and chromatic aberrations as an optical apparatus, and in the adoption of a theory explaining the principles of vision. Still this, although it has carried us immensely beyond the practical limits of a quarter of a century ago, is also limited in its application. The great "apertures" of modern objectives involved the discovery of new optical glass, and the perfected optical system (the "apochromatic" system) required for its highest results a fluid "medium" rendering the source of illumination (the condenser), the object itself, and the object-glass homogeneous. The limit of the usefulness of the system is at present the difficulty of finding suitable fluid media, *i.e.*, with suitable refractive and dispersive indices, and at the same time non-injurious to animal and vegetable substances under examination. Thus, the optician has provided an objective having a so-called "numerical aperture" of 1·63, but no medium has yet been found to make it of practical use to the biologist. Another way, therefore, has been suggested as practicable, which is such a construction of the optical system as will admit of the most efficient use of smaller wave-lengths only of the light ray; object-glasses not merely used with monochromatic (blue) light, but so constructed as to employ it with the finest results with rays having a sufficiently short wave-length to be visually perfect as well as actinically active—the objective being corrected specially for this. It is calculated that with a ray having a wave-length of 0·35 μ, instead of ordinary daylight composed of rays of a mean wave-length of 0·55 μ, the same advantage would be gained as if apertures of our present objectives were increased from 1·40 to 2·20. When we see what advances have actually been made during the last sixty years, can we not anticipate as much more during the next sixty? Upon this question a few words from the same specialist will greatly assist us. He says:

"This is the more conceivable on account of the enlarged possibilities that photography—which during the last two decades has been so great an aid to microscopical investigation—may yet be enabled to afford.

"So far, however, as we are able to see, the practical use of the instrument will be brought out—though with more efficiency—along the same lines in which it has been hitherto used: in minute embryology, in the study of the development of cells and the minute structure of organic tissues, animal and vegetable, in morbid anatomy and pathological research, as well as in many departments of physiology—especially in the complete study of minute organic forms directly causing disease to animals and man. This last is a region of great possibility: already remarkable work has been done from which the human race and immense numbers of domestic animals have derived untold benefit. As a department of sanitary science it is, however, in its early days. Advances in the optical power of the microscope and increasing application on the part of qualified and equipped observers, will open an entire world of microscopic work and successful investigation to them.

"With this also goes the devising by experiment of means of immunity from the scourges arising from these minute organic forms.

"So, also, the study of minute biology in all its forms, as well as the minute structure of inorganic substances. This is sufficiently manifest in the work recently done on

the microscopic structure of metals under different treatment, and especially of alloys, giving us a knowledge of their nature we never before possessed. The whole science of crystallography and micro-petrology, indicating or establishing the origin of minerals and rocks—leading, indeed, to the entire subject of micro-geology, involving a knowledge of the nature of limestone, for example, or the ultimate structure and primary origin of coal, to say nothing of the palæontological certainties in minute structure, for which, in the future, we shall be more and more indebted to the microscope.

"The medico-legal aspect of microscopical research may have a large future. The distinction between human blood corpuscles and those of some other mammals is at present not readily distinguishable, but the difference will certainly be determined by the work of the future. So, too, the micro-chemistry of many poisons can now, and in the future will, be more completely detected than is usually supposed.

"The condition of the atmosphere in different localities, as showing the presence in greater or less numbers of dangerous or putrefactive organisms, can only be demonstrated by the microscope; and for determining specifically the evils which water may contain, not only the chemist but the micro-biologist must be appealed to."

These are, truly, only indications of what may be; but some of them are pregnant with potent possibilities for the future welfare of the people.

We have seen how geology began its career as a close ally of mineralogy, and the mutual assistance which geology and biology have all along rendered to each other. Prof. Cole is of opinion that "the utilitarian aspects of geological discovery are likely to be entirely (and very justly) masked in the future by the humanitarian and philosophical aspects, which will become more and more widely realized. For the present I anticipate the most utilitarian discoveries as follows:—(1) Tracing the coal measures below Cretaceous beds from Dover towards London, at a depth of about one thousand feet. County Councils should *at once* obtain powers for suppression of smoke and periodical removal of refuse heaps from pit mouths, otherwise our south-eastern counties may become ruined, like so much of our desecrated Midlands. The result, however, would be that coal might be sold in London at about fifteen shillings per ton. (2) Miners will become less tempted to waste money in impossible speculations, such as sinking for coal in Ordovician black shales, as has often been done. But I fancy that the actual practice of mining will owe more now to engineering than to geological discovery. (3) Greater knowledge of earthquake waves and tremors, and their possible periodicity, as is now being gained at so many observatories—notably in Japan—may lead to the actual prediction of dangerous earthquakes. (4) Study of the rise of internal temperature may lead to the actual use of the enormous internal heat-stores of the earth."

In the domain of chemistry many possibilities are looming in the distance. If we cannot make quinine, we have a partial substitute in antipyrine, and its introduction into therapeutics has lowered the price of the alkaloid—like the ultramarine, which was formerly dearer than gold, the artificial ultramarine being more beautiful than the natural, whilst for the price of a single ounce of the latter we may now obtain many pounds of the former. Another problem is the synthesis of our daily food, such as sugar, gum, and starch. All that we know of the so-called albuminous bodies is their percentage composition, and that the linking of the atoms is hybrid, as it were, partaking more or less of both the aliphatic compounds and the aromatic bodies. There are those who still hope, with the development of electricity, to build up the *formative* elements of living organisms.

Moissan's electric furnace is a device for effecting chemical changes of which the last has not yet been heard. His preparation of a compound harder than diamond, as well as diamonds themselves, the formation of several carbides, the volatilization of refractory substances, etc., are probably only the early instalments of a long list of new things. Moissan's beautiful specimens of chromium, variadium, uranium, zirconium, tungsten, molybdenum, and titanium, foreshadow the opening up of a vast field of industrial application, an inheritance of great promise for the almost immediate future. How are they likely to be useful? Prof. Roberts-Austen says: "It must be confessed that as yet we know but little what services these metals will render when they stand alone; we have yet to obtain them in a state of purity, and have yet to study their properties; but when small quantities of any of them are associated or alloyed with other metals, there is good reason to believe that they will exert a very powerful influence." It really seems as if we are coming to an age when the dreams of the alchemists will, in a sense, become realized—the age of the wholesale transmutation of metals is at hand; as yet we have only received an earnest of the advantages which alloys can contribute to the art of working metals. If we cannot appropriate to ourselves the experiences and results which futurity has in store, we can, so to speak, prolong our lives backwards into the past by utilizing the legacies of our predecessors in the scientific vineyard. "The more general introduction of electrical processes into chemical manufacturing," says Prof. Thorpe, "is bound to effect great changes. The application of electrical energy has completely altered the aspect of the metallurgy of aluminium, copper, and the alkali metals, and it now threatens the supremacy of the established methods of manufacturing alkali and chlorine." But still there are not a few who, looking to the future, pin their faith mainly on purely chemical means as the vehicle for carrying us forward in the onward march of progress to the ideal.

Many good things are expected from the electricians—the intellectual atmosphere is bristling with projects which will probably at no very distant date greatly modify the little ugly world we have so long been trying to transform into something which shall more closely resemble the ideal of the Utopian dreamers. Edison says: "I predict that in twenty-five years hence, electricity will have superseded horses entirely in New York City in the performance of every sort of useful work. The horse will have become a mere luxury, toy, and pet." But perhaps the most interesting new departure imminent at the present moment is the system of signalling through space—practically a mode of telegraphing from one place to another without intervening wires. Our own countryman, Mr. Preece, is closely associated with this novel means of transmitting messages. It appears that the principle of the system depends on the induced currents in parallel circuits, so well known, the distance between two stations being the distance between these parallel circuits, which may be separated by a river, channel, etc., but still remaining parallel to each other; so that if the secondary circuit be so situated as to be washed by the ethereal waves from the primary, their energy is transformed into secondary currents which can be made to affect a telephone. In Marconi's system the transmitter is Righi's form of the Hertz radiator excited by an induction coil controlled by a Morse key. The receiver consists of an exhausted glass tube tightly fitted with two silver poles, the space between them being filled with nickel and silver filings, mixed with a trace of mercury—the powder being

normally an insulator, but conductors when electric waves fall on the particles. A passing current, therefore, was arranged to ring a bell, or signal in other ways; but to render the filings again non-conductive, a local current is made to work a hammer-head which shakes the filings back into an insulating condition—a receiver, indeed, which, as Mr. Preece says, is "about the most delicate electric instrument we possess." By its aid signals have been transmitted across the Bristol Channel between Penarth and Brean Down, a distance of nearly nine miles. If a receiver is to respond to a certain transmitter it must be timed to accord with it, or, if not so timed, no effect will result. It is curious that hills and other obstructions fail to retard the effects, nor has the weather any influence, while the receiver may be placed in a perfectly closed metallic box without entailing any baneful effects. Mr. Preece considers that the employment of this device in the public service would greatly enhance those ends and aims where secrecy is the dominant element. Enough has been done to show its value in that direction, and for shipping and lighthouse purposes it is regarded as a priceless acquisition.

And who gathers in the firstfruits of new scientific discoveries? Is it the people—is it humanity as a whole? No; the Government is the reservoir into which all the new things worth having flow, and we get just what escapes through the leaks. What does the Government do to help on the band of workers who are patiently groping their way through the dark unknown? Four thousand pounds a year is all that we get—less than the crumbs which fall from the richly furnished tables of our naval and military protectors. Chemistry has supplied them with explosives, electricians with easy channels of communication—harmless and otherwise—engineers with steam hammers, etc., which have rendered possible the making of heavy ordnance; and these, and a thousand other products of scientific thought and action, drift in the main to protect us from our possible enemies. Sir Lewis Morris says: "The whole of Europe is one immense camp, maintaining in idleness, out of the labour of the people, millions on millions of young men, armed with weapons of incredible cost, marching and counter-marching futilely over every European country, not adding one penny to the national wealth—a canker at the core of civilization, a constant source of corruption and vice, sinking Europe in bankruptcy, sapping by their vices the precious vigour of the race, filling men—and women, too—with ideas of false glory deeper than the lowest depths of shame, perpetuating narrow jealousies and suspicions fatal to any idea of the brotherhood of man." It would be a glad day for science in England if in this year of Jubilee our Government could be induced to begin to look with more appreciation on those who contributed so much to make the sixty years of Queen Victoria's reign unique in the history of the world.

There is, indeed, no vein of science too abstract for future industrial application, not yet thoroughly mined out and exhausted. The everyday progress of the arts abounds in new applications of objects the most familiar. Science may see an horizon bounding her view, but as she proceeds onward the horizon constantly recedes, and shows the limit to be altogether illusory. As we have seen, the growth of scientific discovery is slow. In its study we are never sure that the morrow may not gladden the world with an application of a principle to-day abstract, and apparently remote from practice. Science is too lofty for measurement by the yard of utility—too inestimable for expression by a money standard. There never was a time when it was so necessary as now that skill and science should be united for the promotion of the industrial arts. Intellect is on the stretch to get forward, and that nation which holds not by it will soon be left behind. And how, except through earnest scientific study, can we attain the knowledge that shall enable us to discover the pathway leading towards perfection? Remember the words of Lactantius, when the Council of Sages at Salamanca negatived the idea of a western continent: "Is there any one so foolish," says he, "as to believe that there are antipodes with their feet opposite to ours; people who walk with their heels upwards and their heads hanging down? That there is a part of the world in which all things are topsy-turvy; where the trees grow with their branches downwards, and where it rains, hails, and snows upwards?" In looking hopefully into the future let us remember this, and be not dismayed because of the sneering cry, *Cui bono?*

ON THE VEGETATION AND SOME OF THE VEGETABLE PRODUCTIONS OF AUSTRAL-ASIA.—III.

By W. BOTTING HEMSLEY, F.R.S., F.L.S.

IN order to avoid crowding all my figures illustrating flowers and fruits, or seed-vessels, of the gum trees, into one article, I described the peculiarities of the structure of the flowers in my last. It would have been more in accord with development to have commenced with the tree itself, and followed with its leaves, flowers, and seed-vessels; but it is not a point of importance here.

Dampier likened the gum trees he saw to apple trees in size, but the different species exhibit great diversity in habit, some of them, indeed, not being trees. I have said that they range from north to south, from the hottest of tropical regions to the temperate south; a few of them also reach the tree limits in the mountains of Tasmania and South Australia, where snow and somewhat severe frosts prevail during several months of the year. Two or three species ascend even to altitudes of four thousand to five thousand five hundred feet in the Australian Alps, where, however, they only attain the dimensions of small shrubs, flowering and fruiting when two or three feet high. On the other hand, several species attain enormous dimensions in favourable situations, such as deep glens, and exceptional trees are the tallest in the world. Particulars on this point will follow.

I will now try to give an idea what a characteristic large gum tree is like. In foliage it more nearly resembles a narrow-leaved willow than any of our other trees, but the leaves are much thicker, usually more or less oblique, or sickle shaped, and the surfaces are vertical instead of horizontal, as in most other trees. This disposition of the leaves exposes the smallest surface to the direct rays of the sun, an arrangement believed to be of great advantage in the domestic economy of the tree, taking into account the climatic conditions. In habit—that is to say, in outline, manner of growth, branching, and general appearance—there is great diversity in gum trees, some bearing a resemblance, as Dampier states, to large apple trees; but the characteristic of the very tall-growing ones is a massive trunk, branchless to a great height, and a comparatively small crown, with the ultimate branchlets slender and drooping. In seedlings and young trees, and in shoots arising at the base of the trunk, the leaves are commonly in pairs, one opposite the other, of a larger size and different shape, and with the surface spread out horizontally. The presence of numerous glands in the

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leaves, in which the secretion is highly aromatic and of an oily or resinous nature, has gained for gum trees the reputation of being of great hygienic value in malarious countries. How far the action is direct, and how far merely indirect, is uncertain; but there is no doubt that beneficial results have been attained by planting gum trees in marshy, unhealthy districts. A striking point in which the species of gum trees differ from each other is afforded by the bark. In some it is clean, smooth, polished, and permanent, as in our native beech; in others it is deciduous—that is, it flakes off, as in the plane tree, but usually in much thicker layers, and in large pieces. Formerly, the Australian aborigines used the bark thus thrown off to construct the only kind of shelter they enjoyed, and many names have been given locally to several species on account of differences in the bark. Especially remarkable among the smooth-barked species is the karri (*Eucalyptus diversicolor*) of Western Australia, whose columnar trunks are often branchless to a height of one hundred and fifty to three hundred feet, and taper so gradually that they appear of the same diameter throughout. The paintings of Australian vegetation in the North Gallery at Kew give a good idea of gum tree forests, and also of individual trees.

Having described the structure of the flowers, I will now describe some of the many modifications of the fruit or seed-vessel. Like so many other Australian fruits, it is of a woody nature in all of the species, and sometimes excessively hard, in a comparatively early stage. Returning to the blue gum, the flower of which has already been described and illustrated, we have a fruit of medium size. This species is the one most widely planted on account of its supposed febrifugal properties, and the one most likely to come under the notice of inhabitants of northern latitudes, where—in the western counties of the United Kingdom for example—it withstands all but exceptionally severe winters, and therefore attains a considerable size. Of course no prudent person would think of planting it in this country for profitable purposes. It is a native of Victoria, Tasmania, the islands of Bass's Straits, and the southern part of New South Wales; but there are probably more blue gum trees now planted in other countries than exist in their Australian home. The blue gum tree is invaluable in subtropical or temperate regions where there is a small rainfall. Taking into consideration the comparatively short period—less than a century—that this tree has been known, and that it is less than half a century that its value has been recognized, no one tree has such an extensive literature. Sir F. von Mueller, who devotes much more space to it than to any species of *Eucalyptus* in his "Eucalyptographia," cites nearly a hundred different books and articles devoted to it; and he himself says: "It is not too much to assert that among rather more than one thousand different species of trees indigenous in Australia, *Eucalyptus globulus* takes the first position." Though not the tallest of the gum trees, individuals have been measured in Tasmania up to three hundred and thirty feet high, or more than twice the height of the conspicuous Douglas pine flagstaff in Kew Gardens. In striking contrast to the hard-wooded trees of the northern hemisphere, this and other species of *Eucalyptus* grow very rapidly, and it has been estimated that a forest of marketable timber can be grown in thirty or forty years. This is borne out by facts near home, as, for instance, in the lake district of Italy, and in the malarial swamps near Rome, where trees have attained a height of one hundred to one hundred and twenty feet in less than thirty years.

FIG. 1.—Seed-vessel or Fruit of the Blue Gum, *Eucalyptus globulus*. Natural size. Original drawing.

Comparing the seeds of these gigantic trees with those of our forest trees, such as the oak or the beech, we are surprised at the exceedingly large number and the smallness of their size. In place of the solitary seed produced by each flower of the oak, we have a seed-vessel divided into four or five compartments, each containing a number of seeds varying in size in different species from one-twentieth to three-fourths of an inch in length. Even the longest ones are very slender. The seeds of the blue gum are about one-tenth of an inch long, and it takes about ten thousand fertile ones to weigh an ounce. They differ as much in shape as they do in size; and what is more remarkable, by far the larger number in each seed-vessel are sterile, and differ in shape from the fertile ones. The latter retain their vitality for several years—some species for at least a dozen years—and this property, together with their smallness, renders it easy to introduce the gum trees into the most distant countries.

FIG. 2.—Cluster of Seed-vessels of *Eucalyptus amygdalina*. Natural size. Original drawing.

To illustrate the variety offered by the seed-vessels of the gum trees I have had figures drawn of a few of the most diverse forms. The smallest known to me is that of *E. crebra*, a species ranging from the shores of the Gulf of Carpentaria to Port Jackson in New South Wales, which has a fruit about an eighth of an inch in diameter. It is a tree, sometimes one hundred feet high, having extremely slender ultimate branchlets. But I have selected the more noteworthy *E. amygdalina* to represent the small fruited species. This inhabits the colonies of New South Wales, Victoria, and Tasmania, and, as Mueller says, "is one of the most remarkable trees in the whole of creation." I cannot do better than quote from him, as he wrote from personal observation:—"Viewed in its marvellous height, when standing forth in its fullest development, on the slopes or within glens of mountain forests, it represents probably the tallest of all trees of the globe. Considered as a hardwood

FIG. 3.—Cluster of Seed-vessels of *Eucalyptus cornuta*. Natural size. Original drawing.

tree, of celerity in growth it ranks among the very foremost; regarded in reference to its timber, the tall variety can fairly be classed with the superior kinds of its genus; and contemplated in respect to the yield of volatile oil from its copious foliage, it is unsurpassed, and perhaps not equalled, by any other tree in the world!" In different districts it bears the names "white gum," "swamp gum," "mountain ash," "peppermint tree," and "messmate tree"; and the aborigines of Gippsland call it "wangara"—literally, strong bark. A number of different trustworthy and competent observers have put on record the measurements of individual trees; the tallest being four hundred and seventy-one feet high. But this was a standing tree, and there may have been some error in the measurement. A prostrate tree in the Dandenong Range, Victoria, was found to be four hundred and twenty feet long and two hundred and ninety-five feet up to the first branch, where the trunk was four feet in diameter; and at three hundred and sixty feet it was still a yard in diameter!

FIG. 4.—Cluster of Seed-vessels of *Eucalyptus Lehmanni*. Natural size. Original drawing.

For purposes of comparison, a figure of the fruit of *E. cornuta* is given. The beak-like prolongation consists of the lignified styles, as they are termed, through which the pollen grows to fertilize the ovules before they can grow into seeds. This is the yate of Western Australia, and only exceptionally attains a height of one hundred feet; but it thrives even in moist tropical climates, and has been known to make as much as ten feet growth in one year.

E. Lehmanni, from the same region, has a similar fruit. It is one that I mentioned in a previous article as having a long cap or operculum to the flower, sometimes used as a cigarette-holder. This species first flowered at Kew in 1875, and is figured in the *Botanical Magazine*, plate 6140. The cap is a brilliant red, and the stamens bright yellow, so that the tree is a very striking object when in flower.

FIG. 5.—A single Seed-vessel of *Eucalyptus ptychocarpa*. Natural size. Original drawing.

E. ptychocarpa and *E. calophylla* represent another type of fruit. The former is a native of tropical Australia, in the north-west, including Melville, and is still imperfectly known. *E. calophylla* is a native of the extreme south-western extremity of the country, and is remarkable for its handsome foliage. It is called red gum, and although occasionally reaching a height of one hundred and fifty feet, it is never a very tall tree. It is, however, associated with the karri (*E. diversicolor*) and the jarrah (*E. marginata*), trees of enormous magnitude—the karri especially being a very tall grower. Mueller mentions having seen many trees approaching four hundred feet in height, and one that was three hundred feet up to the first branch. The jarrah is now extensively used for street paving in London and elsewhere.

Eucalyptus pyriformis has a totally different type of fruit. It is closely allied to *E. macrocarpa*, the flower of which was described and figured in a former article, and it is also a native of Western Australia. Both are shrubs, flowering when only three or four feet high; and both are comparatively rare—the latter, indeed, very rare—and likely soon to become extinct. It is a noteworthy fact that the very large flowered and large fruited species of *Eucalyptus* are shrubs, whereas the largest of the gum trees, *E. amygdalina*, has almost the smallest flowers and fruit of the genus.

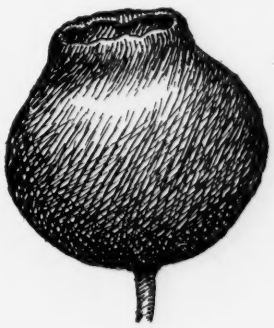


FIG. 6.—A single Seed-vessel of *Eucalyptus calophylla*. Natural size. Original drawing.

Another and still more remarkable fruit is that of *Eucalyptus tetraptera*. The specific name has reference to the four wings or sharp angles of the fruit, and this character often appears in vigorous shoots, which are square and prominently quadrangular. The leaves—in shape something like those of the common laurel, but at least three times as thick—are even more extraordinary, being so rigid, woody, and stiff as to remind one of conventionalized leaves in ironwork. On young, vigorous shoots they are sometimes as much as a foot in length. This, again, is a shrubby species, rarely exceeding ten feet in height, and it is also a native of Western Australia—where, indeed, there is the greatest concentration of those

FIG. 7.—A Seed-vessel of *Eucalyptus pyriformis*. Natural size. Original drawing.

singular vegetable forms peculiar to that wonderful country. It grows chiefly on granitic hills, and Mueller classes it among the most ornamental of the genus.

The foregoing disjointed account of the peculiarities of the gum trees might be almost indefinitely expanded, but

I have perhaps written sufficient to give an idea of the totally different character of the predominant forest trees of Australia from that of the forest trees of the northern hemisphere. I had almost forgotten to mention the extraordinary size of the trunks of some of these giants. I find many records of trunks between twenty and thirty

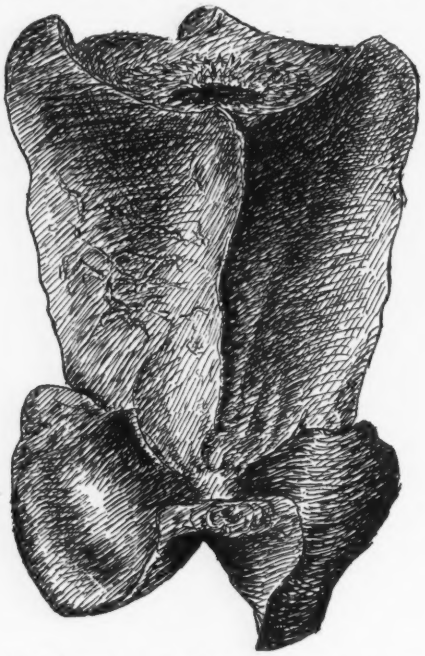


FIG. 8.—A Seed-vessel of *Eucalyptus tetraptera*. Natural size. Original drawing.

feet in girth at five feet from the ground, and Mueller mentions a buttressed tree of the jarrah which measured sixty feet in circumference at six feet from the ground. I may add, too, that a cubic foot of green jarrah wood weighs about seventy-five pounds, and, when dry, about sixty pounds. If properly seasoned it is impervious to the marine teredo and the terrestrial white ant, which few other woods can resist.

With regard to the leaves of gum trees, there are some singular deviations from the typical form described above. Thus, in one species they are sometimes as much as six or eight inches broad, and proportionately long; in another, the opposite leaves are combined at the base and encircle the branches like the upper ones of the common honeysuckle; whilst in *E. peltata* the stalk is attached above the base of the blade, as in the nasturtium.

My next article will be devoted to the *Proteaceæ*, a family of plants having by far its greatest concentration in Australia, and presenting such an extraordinary diversity in external form (associated with essentially the same kind of floral structure) as to have suggested its botanical designation.

Letters.

[The Editors do not hold themselves responsible for the opinions or statements of correspondents.]

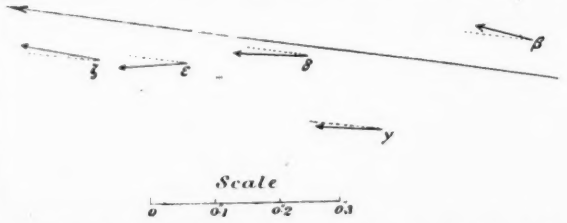
STAR SYSTEMS.

To the Editors of KNOWLEDGE.

SIRS,—Mr. Monck, in your May issue, page 117, states that when he said the proper motions were not exceptional in the case of the five stars, β, γ, δ, ϵ, and ζ Ursæ Majoris, he was referring to the *quantity*; but may I point out that, in considering what stars belong to a system, the question of the *direction* of the proper motion is just as important as any other? I do not see how anyone can examine the map at the end of Proctor's "Universe" without concluding that the proper motions of these five stars are very remarkable, and the figures furnished by Mr. Monck on page 117 do not alter the fact. It is not easy to see from this table the full significance of the figures, and I have therefore had a diagram drawn, where the stars are traced from Proctor's "New Star Atlas." Of course, so considerable a portion of the sphere cannot be represented with perfect accuracy on a plane surface, but the diagram is sufficiently near the truth for practical purposes. It differs little from that in KNOWLEDGE for November, 1896, page 251; but I have added a dotted line to each star to represent the average proper motion of the five (·111 seconds of arc in amount), the direction of which is also approximately shown by the long straight line. The following table shows the deviation in each case of the actual from the approximate average proper motion. The second column shows the deviation measured along the line representing the average direction; the third column that at right angles to this line; and the fourth a combination of the two, showing the total deviation of the particular proper motion from the average—*i.e.*, it is the distance between the extremities of the two lines for each star, or the amount of the proper motion of the individual star as distinct from that of the system—this individual proper motion including also errors of observation and of measurement of the drawing.

Name.	Col. 2.	Col. 3.	Col. 4.
β	−·018″	+·016″	·024″
γ	−·013	−·002	·013
δ	+·015	−·010	·018
ϵ	+·003	−·024	·024
ζ	+·022	+·012	·026

It will be seen that the motion of none of these stars differs from the average by more than 0·026″, which is only about $\frac{3}{5}$ the average of the whole five. Surely,



when the deviation is so small as this, we must conclude the stars belong to one system.

Proctor says one may feel absolutely certain that these five stars belong to one system. I take it this is the statement to which Mr. Monck objects. It may be that it is an exaggeration of the facts; but, if so, surely it is a very slight one. Cannot we at least safely say that the majority of these five stars belong to a single system? It is conceivable that a star might by chance have nearly the same proper motion as its neighbour; but can we believe that this could be the case with five stars in such near agreement? However overwhelming the idea of so vast a system may be, there is no possible escape from it, no matter what assumptions we may make as to the distance of the stars from us.

Of course there is the question: What do we mean by a system? Perhaps there may be a difference of opinion on

this point. I take it that we do not necessarily imply that all the stars are revolving round one another, but that there is in some way a physical connection which differentiates them from other stars. We mean a group; though not necessarily one separated by wide spaces from all other groups, for it is possible two or more might be mixed together and yet really distinct, as shown by their different motions—just as it is possible for two swarms of meteors to move through each other, and yet for each swarm to be quite distinct.

One of the most important points with reference to the proper motion of these stars is that it is nearly opposite to that which would be caused by the sun's motion. This expression, "the sun's motion," is a very vague one (a fact which is often forgotten); but what Proctor appears to mean in the present instance is the motion of the sun with reference to the average of the few thousand stars that are nearest to it. Now, as we have very little idea of the distance of the five stars in question, we cannot tell their speed; but in any case we see that their motion with regard to these few thousand stars is roughly in the same direction as that of our sun, but swifter. Let us call this their "relative motion." Their distance from us is hardly likely to be less than $\frac{3}{5}$ that of the average of the one-magnitude stars; and, according to Proctor's map of proper motions, in that case the relative motion of these five stars is twice as great as the sun's, *i.e.*, as that part of the sun's which is at right angles to the line joining the sun with them, and is therefore $\frac{7}{4}$ of the whole of the sun's relative motion. If they are more distant, their relative motion is swifter.

In this letter I have dealt only with the motion of the stars at right angles to the line of sight.

T. W. BACKHOUSE.

West Hendon House, Sunderland.
May 27, 1897.

To the Editors of KNOWLEDGE.

SIRS,—The question of star systems is one of sufficient interest to justify some further discussion. I am disposed to think the apparent common drift of stars in certain localities (when the direction of the motion is pretty much the same but the amount is different) is mainly due to the motion of the sun in space. Let me take some examples from Prof. Porter's catalogue of stars with a motion of half a second per annum or upwards. This catalogue contains β, η, and μ Cassiopeiæ. The position angles are respectively 110·4°, 113·8°, and 114·9°—a very close agreement; but the quantities are 0·54″, 1·19″, and 3·73″, the last being seven times as great as the first. Can we suppose that these three stars have really a common proper motion, and that the difference in quantity is due to their respective distances from us, β being seven times as far off as μ? Or is it not more likely that they are three stars with small real proper motion situated at different distances from us, and whose apparent proper motion is almost entirely due to the motion of the sun?

With a view of obtaining some further light on this subject I examined the motions of the other stars in this catalogue whose R.A. is between 0h. and 2h. and Decl. between 45° and 70°. Here is the result:—

Star.		Position.		Direction of Motion.
Lalande 47231	...	0h. 0m.	+ 45° 15′ ...	98·3°
Lalande 1966	...	1h. 3m.	+ 61° 0′ ...	90·0°
Fedorenko 263	...	1h. 34m.	+ 66° 25′ ...	107·7°
Piazzi 1h 159	...	1h. 40m.	+ 63° 21′ ...	112·8°

These angles are a little less than those in the case of the three stars in Cassiopeia, but the approximation is pretty close, and as regards the quantity of motion they are better agreed, viz., 0·90″, 0·69″, 0·76″, and 0·62″. Had I gone on to the third hour of R.A. I would have got 122·6° and 131·4° for the next two direction angles, the mean of the six stars being almost the same as that of the three in Cassiopeia, and the difference in no instance being very wide. Further, I found that the position angles for the three stars in Cassiopeia are very near the mean for this Right Ascension.

I may note that in this catalogue of three hundred and one stars, taking each hour of R.A. separately, the mean position angle was always less than 180° from 0h. to 6h., from 6h. to 7h. it was almost exactly 180°, then from 7h. to 19h. it was always greater than 180°, and from 19h. to 24h. it was again less. The maximum deviations from 180° on each side occur at about 0h. to 1h., and 12h. to 13h. They were not quite equal, however, the former somewhat exceeding the latter.

I tried the southern stars in the catalogue within the same limits as the foregoing, when the direction angles proved to be 55·9°, 122·0°, 64·5°, 76·2°, and 65·5°. Four out of these five are in very close agreement, and the last three were pretty well agreed in quantity, viz., 1·00″, 0·71″, and 0·72″. But their positions on the sphere are hardly consistent with the assumption that they belong to the same system.

Between 3h. 30m. and 5h. 30m. of R.A., and 40° and 50° N. Decl., there are four stars with proper motion of half a second and upwards. Their direction angles are the following: 154·2°, 127·2°, 145·1°, and 141·7°.

On the other hand, I find in several instances two stars with large proper motion situated near to each other in the sphere and yet moving in very different directions. Apparently they do not belong to the same physical system, notwithstanding their comparative nearness to each other. This increases the probability that the apparent common drift of others really results from the sun's motion. Thus Groombridge 2305 and Lalande 29439 are situated much nearer to each other on the sphere than those which I have been considering, and they have nearly the same proper motion in quantity; but the direction angle in one case is 275·2° and in the other 159·4°. Lacaille 2740 and T Puppis are not very remote on the sphere, and, judging from the amount of their proper motions, are situated at about the same distance from us. The angle in one case is 342·5° and in the other 183·1°. The motion of Lacaille 2957 is more directly opposite to that of 2940, but the distance on the sphere is somewhat greater. ζ and ω Herculis both appear in the list. The angle in one case is 311·7° and in the other 172·9°. But it will be noted that all the stars which I have referred to as exhibiting this opposition of directions are situated in a part of the sky where the sun's motion would have little influence.

My conclusion is that the sun's motion affects the proper motions of the stars to a greater extent than is commonly supposed. When the observed proper motion is very small it is largely affected by errors of observation, and the effects of solar motion are thus disguised. But when the observed motion is so large that errors form but a small proportion of it, the effect of the sun's motion becomes plainly manifest. These latter stars are probably travelling with more than average velocity (in the direction perpendicular to the line of sight), yet their motions appear to be more affected by that of the sun than those of other stars which are moving with less absolute velocity. I can only explain this fact by supposing that the smaller observed proper motions are largely affected by errors. At all events, before we ascribe a common drift to a large number of stars in some particular

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region of the sky, and infer that they belong to the same physical system, we should study with greater care the effects of solar motion and the limits of probable error. Errors of observation might, of course, tend to conceal the evidence of a real physical system, but they might also fabricate evidence in favour of an imaginary one. Generally speaking, if three stars, A, B, C, are presumably at about the same distance from us, the distance A C (measured on the sphere) being greater than either A B or B C, it seems unlikely that A and C should be members of a physical system of which B is not a member; and proper motion is, I think, now admitted to be a better test of distance from us than magnitude. This consideration is not favourable to the reality of many supposed star systems.

W. H. S. MONCK.

"THE" GLACIAL PERIOD.

To the Editors of KNOWLEDGE.

SIRS,—I am not going to attempt the defence of Dr. Croll's theory of glaciation, but, as Mr. Monck appears to be desirous of a further consideration of the subject, I will attempt to rectify a few of his conclusions.

Dr. Croll thought he had proved his case of the cause of a glacial period by showing that the eccentricity of the earth's orbit reached such an extent that, combined with the action of precession—by which winter would occur in the northern hemisphere at the same time as the greatest eccentricity—what may be fairly called a permanent ice-cap would be formed at the North Pole. In his argument Dr. Croll erred on the right side as to the number of days per annum the northern hemisphere would continue under these conditions, but Sir R. Ball has since helped him in this respect by showing that the number of days would be greater. Notwithstanding this, it is generally agreed that Dr. Croll's theory hardly accounts for all that has been observed with respect to "the great glacial period." He maintained that a great icecap, reaching as low down as the latitude of Edinburgh, would be sufficient in the course of, say, ten thousand years to alter the inclination of the axis, and so tend still more to add to the intensity. Also that this would have the effect of a redistribution of the oceanic water, so that (taking England as an example) the whole island would be covered with water, the icecap would reach to latitude 55°, and south of that the water would be more or less frozen and covered with floe-ice. A little calculation will show that an angle of half a degree, starting from the latitude of Paris, would, if continued to the Pole, equal a thickness of twelve miles of ice. This would give a depth of water of two thousand feet over the midland counties of England.

I have always considered that there are other conditions which might considerably help this glaciation. In the first place a great continent of ice—five thousand miles in diameter, and ten miles thick at the Pole—would be sufficient of itself to attract a vast body of water, and this would cause a diversion of the Gulf Stream by reason of (*a*) its having no outlet to the north, and (*b*) the different level of the water.

Mr. Monck's argument that the greater heat of a short summer sun would have the effect of melting the snow and ice is not borne out by practical observation, as, although the sun shines on the Polar snow for six months, it has but very slight effect upon it, as the old rock ice is invariably met with a foot or two below the surface. Even in the Alps—owing to radiation—the sun's heat in the height of summer affects the surface of the snow but very little; what melting does take place is underneath, through the warmth of the earth.

Geologists may consider the past erosions too small for Dr. Croll's period, but geologists are not astronomers—and the converse holds good. But if geologists would only argue upon what they see, and not follow their bell-wethers so much, they have plenty of proof that there has been more than one minor glaciation since the great one, *e.g.*, the Cromer forest bed and the brick earth deposit north of the Thames.

There remains the question of precession. It is calculated upon a very short time observation and is known not to be absolutely correct; but if the axis of the earth has been shifted at any time to more than the accepted four degrees, or should the pole of the ecliptic not be the centre of rotation, then of course other circumstances arise which may intensify or modify all these arguments. We are also profoundly ignorant of South Polar action, either astronomically, geographically, or physically. It is in a state of glaciation at the present time. Why? We have much to learn before we can formulate a good all-round theory. Meanwhile, we have to thank Dr. Croll for having suggested a fairly good basis of thought, and for tables and diagrams which will always be useful.

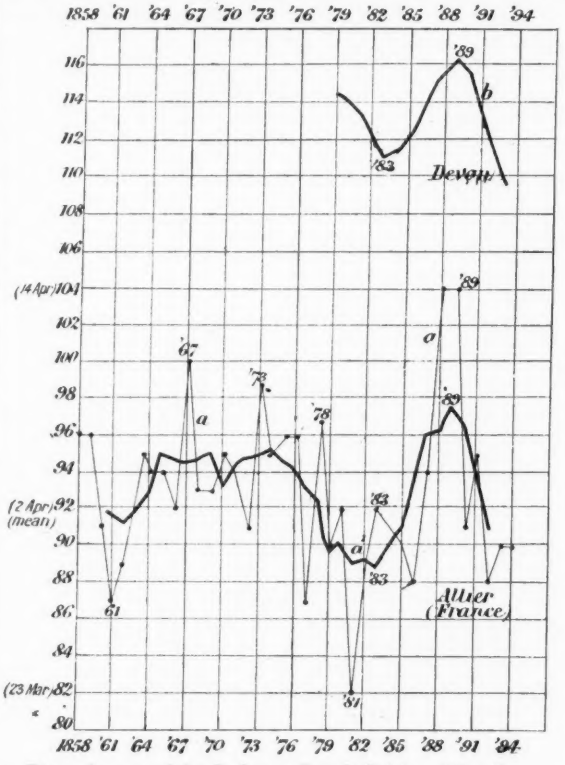
JAS. D. HARDY.

73, Clarence Road, Clapton, N.E.
2nd June, 1897.

CURVES OF THE CUCKOO.

To the Editors of KNOWLEDGE.

SIRS,—There is now, it is known, a branch of science called *phenology*, which deals with the dates of appearance of certain things: the first flowering of plants, the return of certain animals, etc. A valuable report on the subject is presented every year to the Royal Meteorological Society.



a Dates of return of the Cuckoo, at Parc de Baleine, Allier, France.
a' Smoothed curve (averages of five).
b Smoothed curve of Cuckoo in Devonshire.

The graphic method has been applied, to a certain extent, in this science; but I do not remember to have seen curves showing the history of a given phenomenon, in which the high points represent late dates and the low points early dates.

Thus, we might draw a curve of the cuckoo. Having found, in *Ciel et Terre* (16th October, 1894), a list of the dates of return of that bird at a place in the heart of France, I have indicated these in the curve *a*. (For convenience, each date is first translated into the number of the day in the year.) The dates range from 23rd March to 14th April, the mean being 2nd April.

In the smoothed curved *a'*, traversing the other, each year point represents an average of five. A similarly smoothed curve for Devonshire is given above, and it agrees very well, so far, with the French one. The bird, of course, comes later to Devon—about the end of April.

It seems to me that curves of this kind might throw useful light on seasonal changes.

ALEX. B. MACDOWALL.

CAN THE DEAF APPRECIATE MUSIC?

To the Editors of KNOWLEDGE.

SIRS,—In connection with the statement made by Dr. J. G. McPherson in his interesting article in the June Number of KNOWLEDGE, that sensations of sound affect those of colour, I should like to draw attention to the fact that colour sensations caused by sound may in a great many instances be referred to associative ideas. But that a correlation of the senses, in the case of our sensations of sound and colour, actually exists is maintained by very many. A very interesting work has lately appeared here by Richard Hennig,* which deals largely with this subject, and which has awakened considerable interest in musical circles. Though he has been unable to arrive at any very satisfactory explanation of the matter, Herr Hennig cites very many well-authenticated examples where the sensation of colour was produced by sound, and in a considerable number of cases a remarkable amount of agreement is shown. These cases, however, are not of the same order as that mentioned in Dr. McPherson's article, where it is related that Raff compared the sound of the flute with the colour blue. A case of this kind can, as Herr Hennig points out, be more easily explained by association, wood wind instruments being in general used for pastoral effects, which might by association call up the idea of a blue sky. Or, again, an agreeable sound may be compared with an agreeable colour and *vice versâ*. For instance, the sound of a trumpet has been compared with scarlet—the one a lively sound and the other a vivid colour.

In the examples cited by Herr Hennig, however, the sensation of various colours was called up by various keys. Thus, several individuals independently compared F sharp major with yellow. Professor Cart, of Lausanne, is mentioned as having established the following table:—

C major	Brilliant white.
D minor	Grey.
E major	Red.
A flat major	Deep violet.

Whether there can be in these appearances any objective reality or not is certainly a question demanding close attention in scientific inquiry.

Certain it is that in very many cases these colour sensations can be referred to purely associative causes—prove, in fact, on strict examination to be purely psychological and not physiological phenomena. It should also be borne in mind that the fact of such sensations occurring as a rule among musicians, naturally highly imaginative, may go largely towards pointing to their psychical origin.

W. ALFRED PARR.

Nettelbeckstrasse, 6, Berlin, W.
June 15th, 1897.

* "Die Charakteristik der Donarten," by Richard Hennig. (Berlin, 1897.)

"LATHER" AND "DILLING."

To the Editors of KNOWLEDGE.

SIRS,—*Apropos* of Mr. Morley's article on "The Language of Shakespeare's Greenwood" in your last issue, which I have read with much interest, I venture to point out that the substitution of the sound of "th" for that of "d" in certain words, is not quite confined to Warwickshire. Mr. Morley will, perhaps, like to know that I have frequently heard "ladder" pronounced as "lather" (to rhyme with "father"), and "fodder" as "fother," by natives of country villages in the Weald of Kent. The word "dilling," too, would be well understood by the denizens of Caxton's country, though it is sometimes pronounced "dawling."

Ashford, June 5th, 1897. A. W. BUSBRIDGE.

Science Notes.

MR. HOWARD SAUNDERS is preparing a revised edition of his well-known "Manual of British Birds." This is very gratifying news, and we venture to say that a new edition of this book brought up to date, say every ten years, would be far more useful to the ornithologist than many of the multitude of books on British birds nowadays published.

Réunion du Comité International Permanent pour l'exécution de la Carte Photographique du Ciel, tenue à l'Observatoire de Paris en Mai, 1896. It is just ten years since the late Admiral Mouchez, then Director of the Paris Observatory, convoked the first congress to discuss the basis on which the "International Chart and Catalogue of the Heavens" should be carried out. Two more conferences were held at successive intervals of two years, in which the general principles and methods of the enterprise were laid down. The following five years, from 1891 to 1896, were fully occupied by the eighteen co-operating observatories in taking the plates for the catalogue, and also, to some extent, those of longer exposure for the chart series. Many questions, however, were now become ripe for discussion, not only dealing with the preservation of the large number of plates already obtained, but also with the instruments and methods of measuring and publishing the resultant places of the star-images. Accordingly, when the conference again met, on May 11th, 1896, they quickly nominated a sub-committee to report on the necessary precision to be attained in the measurement of co-ordinates and in the determination of magnitudes. In connection with this question the Savilian Professor at Oxford submitted the measuring instrument used in the University Observatory to the sub-committee. On their behalf M. Dúner reported that the majority of the observatories attained an accuracy such that the probable error of a single co-ordinate did not exceed 0·15″; but, since it was also most important that the work should be executed in as short a time as possible, they proposed to fix the maximum probable error admissible of a single co-ordinate as 0·20″. The conference finally decided on 0·20″ as a superior limit for the measured co-ordinates, and on 0·20 mag., or at most 0·25 mag., for the probable error in magnitudes.

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These magnitudes might be determined either by measurement or by estimation. Captain Abney raised the important question of controlling the chemical composition of sensitive plates. Commercial photographic plates, he said, might be divided into two extreme types: (*a*) those that are sensitive to bright stars, but require a relatively long exposure to bring out the fainter ones; and (*b*) those which are comparatively more sensitive to the weaker rays than to the stronger ones. Captain Abney proposed to control the varying sensitiveness of these plates to the fainter stars by imprinting on each film at the same time as the réseau a scale of opacities, and which he himself proposed to construct. Other minor questions were also discussed as to the reduction and reproduction of plates and measures, and the conference proposed at their next reunion to entertain measures for coming to the aid of those observatories which find themselves unable to accomplish their share of the catalogue or chart series.

The project for the erection of a statue to Darwin in his native town first took shape in 1894, when Mr. Montford, who is a native of Shrewsbury, placed a sketch model before his fellow townsmen. But it was not until the end of last year that the generous offer of the Shropshire Horticultural Society to defray the whole of the cost rendered the project a practical one. And, even then, the onerous condition was made that the statue should be finished early in August, leaving the artist only some seven months for the execution of the work. The statue is in bronze, and is erected on a granite pedestal; the site chosen is the entrance gateway to the Public Library, formerly the celebrated Shrewsbury School, at which Darwin received part of his education. The work has been viewed by many of Darwin's friends, notably Sir Joseph Hooker and Mr. Francis Galton. Lord and Lady Farrer were particularly pleased with the portrait. We learn that Prof. Francis Darwin and other members of the Darwin family lent the sculptor their aid during the progress of the work.

CHARLES DARWIN.

The New Statue of DARWIN by Mr. HORACE MONTFORD.
To be erected in Shrewsbury, and unveiled on August 10th, 1897, by LORD KENYON, President of the Shropshire Horticultural Society.

Notices of Books.

The Aëronautical Annual, 1897. (Clarke & Co., Boston, Mass., U.S.A.) This is the third, and certainly the most interesting, of Mr. Means' annuals. Of course, the *chef d'œuvre* is the description of Prof. Langley's world-renowned success in driving an aërial steamer through the air, thus demonstrating beyond dispute that the air may be navigated by steam, not only without the expedient of gas displacement, but treating that old idea with the contempt it deserves, of which Dr. Wölfert's experiment is the latest illustration. Our readers are aware that Mr. Hargrave, of Australia, is the inventor of the cellular kite, and our cousins in the United States have taken up and elaborated the idea, Mr. Chanute being well to the fore in this work. From this side of the art will emanate the best form of gliding or soaring apparatus, Prof. Langley's success supplying what may be called the other side; and, when both have met together, as the result of further experiments, we shall have the aërial steamer, independent of gas bags, and providing the swiftest, safest, and most agreeable mode of travel.

Electro-Physiology. By W. Biedermann. Translated by F. A. Webby. Vol. I. (London: Macmillan & Co. 1897.) All students of physiology will welcome Prof. Biedermann's book as one of the most valuable additions to the literature of this important branch of science. There are few men more qualified than the author to undertake a work of this character, and we are pleased to find that he has not only given details of those contributions to the subject which he is generally associated with, but has endeavoured—and, in our opinion, successfully—to cover the whole scope of our present knowledge of electro-physiology. The work has grown out of the course of lectures which Prof. Biedermann has been giving for some years past at the University of Jena, and which have attracted students from all parts of the world. We feel sure that the work before us is destined to become the standard text-book in electro-physiology for many years to come. The well-known original researches of the author, which have for so many years past been amongst the most valuable contributions to the *Wiener Sitzungsberichte*, are now condensed and summarized and rendered more accessible to English students. The book has the additional merit of containing a very extensive bibliography. The illustrations are not the least important feature of the work, and considerable credit is due to the translator for the lucid and comprehensive manner in which he has reproduced Prof. Biedermann's work to English and American students.

Alternating Currents and Alternating Current Machinery. By Prof. Dugald C. Jackson, C.E., and Prof. John Price Jackson, M.E. (The Macmillan Company, New York.) Illustrated. 14s. Books for students of electrical engineering are often too full of specifications and illustrations

of commercial machinery, or are too strictly theoretical, to be of value to the practical electrician. This volume does not err in either of these directions. It happily combines theory and practice, dealing instructively with the fundamental phenomena of alternating currents as well as their applications. A text-book so planned, and which passed through the refining fire of the lecture-room before it was put into type, cannot but be satisfactory. These qualifications are sufficient to convince teachers and students of electrical engineering that the work of Profs. Jackson is one which should not be overlooked.

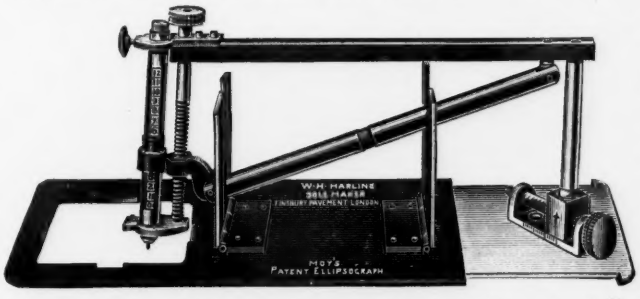
SHORT NOTICES.

English Literature from A.D. 670 to A.D. 1832. By Stopford A. Brooke, M.A. (Macmillan & Co.) 1s. This is a reprint of Mr. Stopford Brooke's scholarly survey of English literature, originally issued as one of the Literature Primers, edited by the late John Richard Green. It has been largely revised and corrected by the author, and contains a full chronological table and index to authors.

The Months, descriptive of the Successive Beauties of the Year. By Leigh Hunt. With Biographical Introduction by William Andrews, F.R.H.S. (London: William Andrews & Co.) 2s. This is a reprint of a delightful little book which originally appeared in 1821. We are glad to welcome its re-issue, though for a totally different reason to that quaintly given by the editor, that when offered for sale the original issue fetched ten times its published price. Leigh Hunt's sunny nature and gentle bearing, his delight at the simplest beauties of nature, and his observant contemplation of her moods, go to make a happy book, and a happy reader, too.

We have received from Messrs. Houghton & Son a very comprehensive and well-illustrated price list of photographic apparatus and materials. It seems to contain a list of everything requisite to a photographer, from cameras, lenses, and shutters, to plates and papers, by all the best manufacturers.

The Ellipsograph. By T. Moy. (W. H. Harling.) 30s. Draughtsmen of all kinds—mechanical, architectural, the engraver—know the value of any contrivance which will facilitate the construction of that innocent-looking curve, the ellipse, which, nevertheless, is most troublesome to draw, even by the approximate methods in vogue, and hence, on account of its frequent recurrence, absorbs much valuable time. We have before us a neat and efficient piece of apparatus—the ellipsograph—which enables one to draw ellipses of every degree of eccentricity with as little trouble as is involved in describing a circle with a pair of compasses, and, at the same time, absolutely accurate. Referring to the figure, a pencil or pen is inserted in the graduated vertical tube and secured by a spring operated by a screw; the semi-axis major is set off by turning the screw of the graduated regulator (on the right) till the arrowhead has moved outwards the required distance from zero, which is exactly over the centre of rotation, and a vertical screw actuating the diagonal limb, which slides telescopically as the angle of inclination varies, is adjusted so that the extreme lateral point of swing coincides with the



outer limits of the minor axis. By now rotating the regulator, using the milled head as a handle, the diagonal piece slides longitudinally, and the top horizontal bar rocks laterally, the compound motion thus imparted to the pencil resulting in a most accurate elliptical curve. The angle of the diagonal bar may be diminished till practically horizontal, in which case circles are traced out. The instrument can be used with great advantage for drawing wheels, etc., in perspective. We may add that it is easily and quickly re-adjusted for drawing all sizes of ellipses within the range of the instrument, which, of course, is limited. As a piece of mechanism it does great credit to the inventor and maker alike.

BOOKS RECEIVED.

Through a Pocket Lens. By Henry Scherren, F.Z.S. (Religious Tract Society.) Illustrated. 2s. 6d.

Lepidoptera. By W. F. Kirby, F.L.S. Allen's Naturalists' Library. Edited by R. Bowdler Sharp. (Allen & Co.) Illustrated. 6s.

Hypnotism and its Application to Practical Medicine. By Otto Georg Wetterstrand, M.D. (Putnam's Sons.) Illustrated. 10s.

Practical Histology. Second Edition. By Edward Albert Schäfer, LL.D., F.R.S. (Smith, Elder.) Illustrated. 7s. 6d.

Some Unrecognized Laws of Nature. By Ignatius Singer and Lewis H. Berens. (Murray.) Illustrated. 18s.

The Induction Coil in Practical Work, including Röntgen X Rays. By Lewis Wright. (Macmillan.) Illustrated. 4s. 6d.

Poems for the Schoolroom and the Scholar. Masterpiece Library. Arranged by Robert S. Wood. (*Review of Reviews* Office.) 6d. net.

Proceedings of the Academy of Natural Sciences. Part III. Edited by E. J. Nolan. (Logan Square, Philadelphia.) Illustrated.

The Migration of Birds. By Charles Dixon. Amended Edition. (Horace Cox.) Maps.

Bird Life. By Frank M. Chapman. (Appleton, New York.) Illustrated.

Grundprobleme der Naturwissenschaft. By Dr. Adolf Wagner. (Borntraeger, Berlin.)

Life in Early Britain. By Bertram C. A. Windle. (Nutt.) Illustrated. 3s. 6d.

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THE HOURGLASS SEA ON MARS.

By E. M. ANTONIADI.

THE most interesting, characteristic, and by far the most easily recognizable feature of the planet Mars is the great, dark, triangular spot of its northern hemisphere, known as the "Hourglass Sea."

No name could have been more appropriate to this marking, not only for the close resemblance the spot bears to an hourglass, but also from the fact that it was the Hourglass Sea itself which acted as hourglass in the determination of the rotation of Mars on its axis.

The name has, however, dropped out of use, having been superseded by the names given by successive areographers. Thus Proctor, in his map of 1867, calls it the "Kaiser Sea" (a name adopted by Green in 1877); others named it the "Northern Sea" or "Dawes' Bay"; while Schiaparelli, who has furnished the markings of the planet with a brand new set of names of his own, calls it the "Syrtis Major," although there is not the slightest trace of likeness in the outlines of the Hourglass Sea on Mars and the Major Syrtis of our own earth.

In general outline the Hourglass Sea is not unlike India, whose Indus and Himalayas would correspond to the "pontes," or whitish "bridges," to which Mr. Lowell called attention in 1894. The total length of the eastern* shore is some thirty degrees; that of the western forty degrees. To the east the shore follows very nearly the two hundred and eighty-second meridian, then curves eastwards into the Lesser Syrtis. The semicircular land formed by this curve is called Libya by Schiaparelli, and

* We are using the words "east" and "west" in their areographical sense. Thus, of two markings, the preceding is the eastern, the following the western.

is, as we shall presently see, the theatre of vast and almost continual changes.

Owing to its remarkable dimensions the Syrtis Major was the first marking ever detected by man on Mars. The honour of this discovery belongs to Christian Huyghens, the distinguished discoverer of Saturn's ring, and ingenious deviser of the first pendulum clock. The accompanying woodcut (Fig. 1) is a facsimile reproduction, after M. Terby, of Louvain (Belgium),* of Huyghens' original sketch, dated 1659, November 28th, 7 o'clock P.M. By following the motion of this spot, Huyghens concluded that the rotation of Mars on its axis ought to take place in about twenty-four hours.

FIG. 1.—The Hourglass Sea on Mars, as drawn by Huyghens two hundred and thirty-eight years ago.

For one hundred and twenty years following Huyghens' discovery, areography made almost no progress whatever; but in the years 1777, 1779, and 1781, Sir William Herschel made a fine series of drawings of Mars, which, in reality, constitute a very marked advance of our knowledge of the planet's surface. The Hourglass Sea was drawn with its true outline, while Herschel's views show at the same time that great inlet which was later named after Nasmyth, and now is more commonly known as the Nilosyrtis. A careful examination of Herschel's drawings excites the suspicion that a notable change may have taken place on the western shores of the Syrtis, towards the southern extremity of Schiaparelli's Aeria, where Banks Cape or Hammonis Cornu was probably considerably more conspicuous in 1781 than it at present is. Schroeter's drawings, however, made twenty years later, give but little support to this view.

The observations of Beer and Maedler (1830-1841) do not increase our knowledge of this part of the planet.

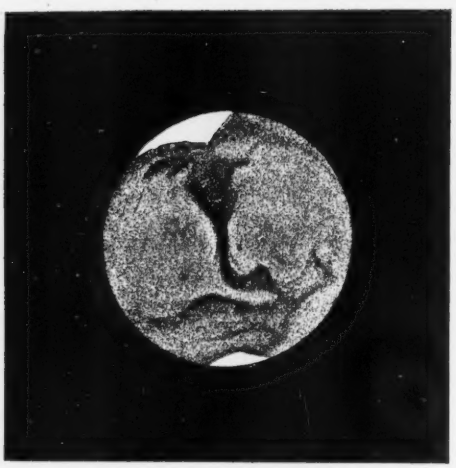


FIG. 2.—The Hourglass Sea on 1856, April 20th. (W. de la Rue.)

In 1856 Warren de la Rue made some very interesting drawings of Mars, one of which, dated April 20th, 1856 (Fig. 2),† is particularly remarkable. Here we have a very fine view of the Hourglass Sea, with its northern inlet, the Nilosyrtis, forming, where it curves westward, a round dark spot, to which Schiaparelli gave the name of Coloe Palus in 1879. The white region at the top of the drawing is not the south polar snowcap, but rather the island of Hellas (Lockyer Land), belonging to that peculiar class of "lands" on Mars which appear of a dull, ruddy hue when near the centre of the disc, but which increase in brightness in the vicinity of the limb, appearing occasionally in this position as bright as the polar snowcaps themselves.

In 1858 Secchi undertook a series of observations of Mars which led to the discovery of a considerable number of what are now so familiar to us as "canals." We choose from Secchi's collection his drawing of June 15th, 1858 (Fig. 3), in which our sea is likened to a scorpion—a certainly not unhappy comparison.

FIG. 3.—The Hourglass Sea on 1858, June 15th. (Secchi.)

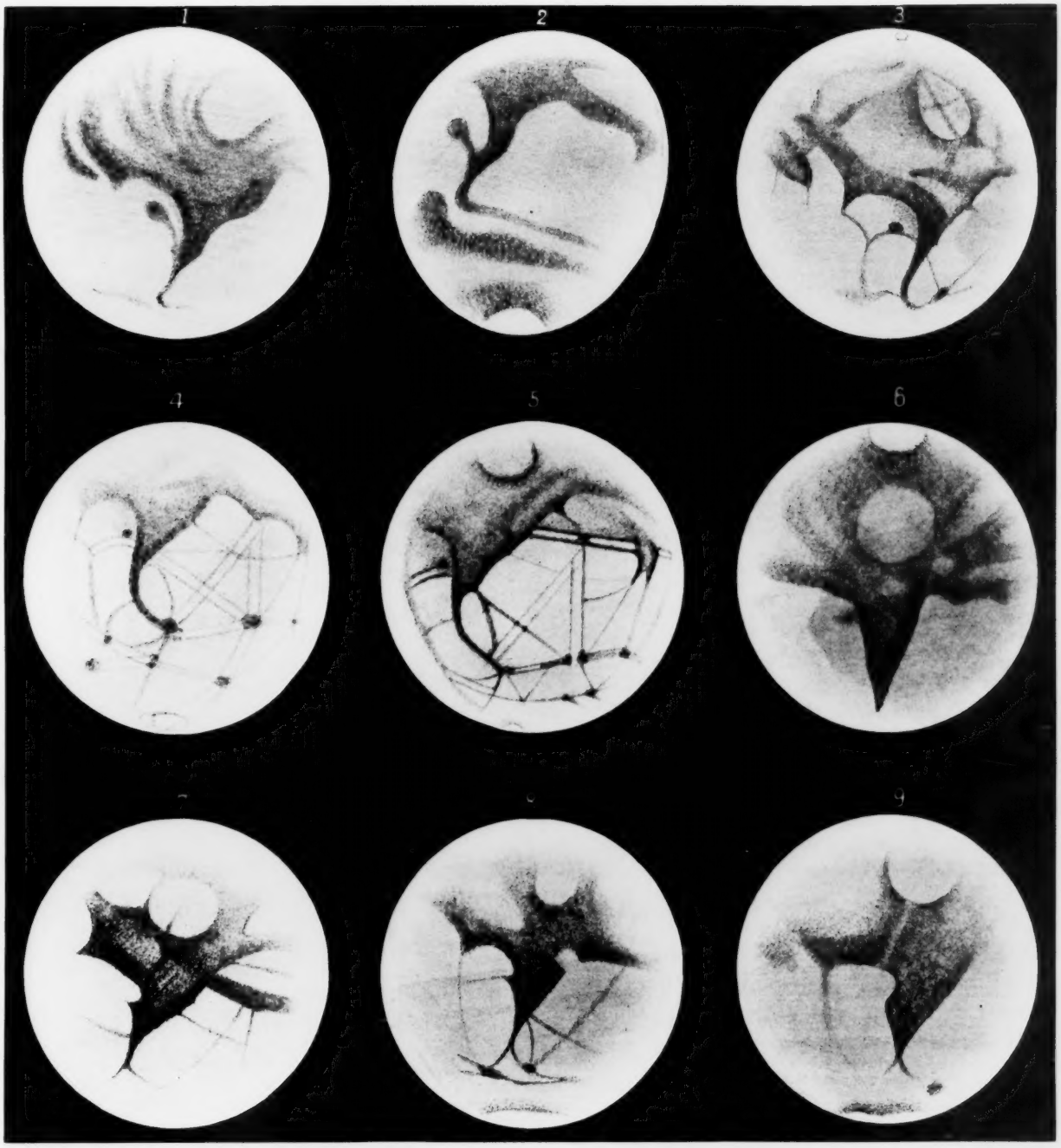
The year 1862 will remain for ever memorable in the history of areography by the excellent observations of Mr. Lockyer, who gave us the first really truthful representation of the planet. Mars was then at one of its perihelic oppositions, consequently almost at its minimum distance from the earth, but unfortunately unfavourably situated to European astronomers on account of its great southerly declination. Lockyer's drawings of the Hourglass Sea region, of which Fig. 4 is one of the best, establish that in 1862 the coast

FIG. 4.—The Hourglass Sea on 1862, October 3rd. (Lockyer.)

of Libya and the eastern shores of the Hourglass Sea were very much like what they were in 1877. Libya seemed somewhat dusky to the south-west, while some very conspicuous features on its surface are the three shadings extending from x to y. These constitute the first proper view of the round dark spot called the Main Sea, and which Schiaparelli has christened by the name of Mœris Lacus. It is possible that this "lake" was triple in 1862,

* *Aréographie* (*Académie de Belgique*, 1875, p. 8).

† We have extracted all the nine woodcuts accompanying this paper from M. Flammarion's admirable monograph, "La Planète Mars." (Paris: Gauthier Villars, 1892.)



THE HOURGLASS SEA ON MARS.

1.—Dawes, 1864, November 26th.
2.—Flammarion, 1873, June 29th.
3.—Schiaparelli, 1879, October 28th.
4.—Schiaparelli, 1888, June 2nd.
5.—Schiaparelli, 1890. June 20th.
6. Gale, 1892, August 6th.
7.—Lowell, 1894, October.
8.—Phillips, 1896, December 3rd.
9.—Antoniadi, 1896, December 7th.

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but what is certain is that, in any case, it appeared large, and was situated almost midway between the two Syrtes,

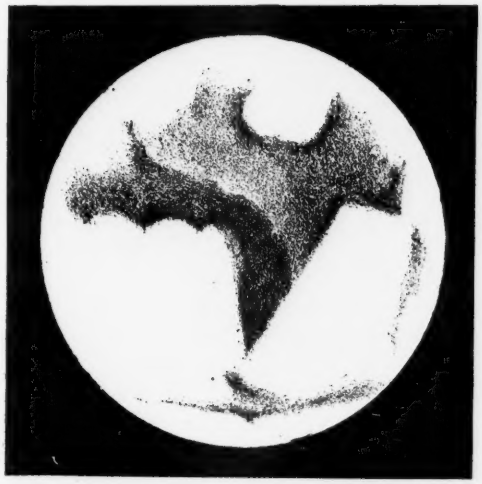

FIG. 5.—The Hourglass Sea on 1864, November 22nd. (Kaiser.)

and very near the centre of the semicircular coast of Libya.

In 1864 the "eagle-eyed" (though short-sighted*) Dawes continued the era so brilliantly inaugurated by Lockyer in 1862, furnishing us with a new set of first-class drawings of the planet. Dawes confirms his predecessor's work, but shows Libya as penetrating deeply into the Hourglass Sea, whose breadth is very much reduced in consequence (*see* the Plate, Fig. 1); its outer edge is a little shaded, while Mœris Lacus, represented as of very large size, is lying, as in 1862, midway between the two Syrtes.

FIG. 6.—The Hourglass Sea on 1864, November 20th. (Franzenau.)

We subjoin two other views taken during the same apparition of the planet, the first (Fig. 5) by Kaiser, showing the Nilosyrtis quite severed from the Major Syrtis—a phenomenon seen again by the Rev. T. E. R. Phillips, of Yeovil (Somerset), on January 15th of the present year; the second (Fig. 6), by Von Franzenau, giving us an unusual visibility of the dusky "land" Œnotria, not unlike the appearance noted by the writer in September, 1896.

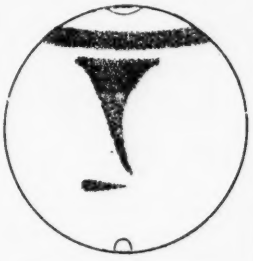

FIG. 7.—The Hourglass Sea on 1871, April 4th. (Gledhill.)

Fig. 7 shows a remarkable and almost unique view of the Kaiser Sea, which is shown as quite separated from the Mare to the south by a bright bridge uniting Libya to Hammonis Cornu.

M. Terby, in 1873, gives a view of one of the bridges discovered by the Parsonstown observers in 1862, and stretching from Libya to Hellas (Fig. 8).

In the same year, 1873, M. Flammarion made a sketch (Plate, Fig. 2) of this region, which shows very neatly that at that time the Hourglass Sea was quite as narrow as it was ten years previously, and that the general configuration of its eastern shores had undergone scarcely any change since the oppositions of 1862 and 1864.

During the famous opposition of 1877, the Syrtis Major was smaller and narrower than perhaps it ever was since its discovery by Huyghens. This shrinking was entirely due to the invasion of ruddy material from Libya. In October, 1877, the Syrtis appeared to end almost at the latitude of Mœris Lacus. The accompanying sketch by Schiaparelli (Fig. 9) will make these descriptions plain. Libya penetrated deeply into the greyish area of the Sea, forming a graceful curve extending right down to the sharply pointed Osiridis Promontorium, in 28° of north latitude. The accuracy of these observations is fully confirmed by Mr. Green's drawings, taken at Madeira in 1877, and constituting, as Mr. Maunder says, the most lifelike representations of the planet ever published.

FIG. 8.—The Hourglass Sea on 1873, May 24th. (Terby.)

In 1879 the Hourglass Sea appeared much broader from the disappearance of Osiridis Promontorium. An immediate consequence of this invasion of the dark material was that Lake Mœris seemed no longer situated midway between the Syrtes, but at rather less than one-third the distance separating the embouchure of the Nepenthes from the Lesser Syrtis. A characteristic feature of the 1879 apparition was a slight shading of the south-western segment of Libya (Plate, Fig. 3).

Analogous phenomena were noted in 1881-1882.

FIG. 9.—The Hourglass Sea on 1877, October 14th. (Schiaparelli.)

The next opposition of 1883-1884 was marked by a further step in the invasion of the dark material of the Syrtis over dusky Libya. At this time no more than a hundred miles separated the lake from the sea, while the brightness of Libya had undergone a further diminution.

In 1886 and 1888 the progress of the dark invasion was a very languid one. A sketch by Schiaparelli (Fig. 4 of the Plate) shows Libya always shaded, while the gemination of the Nepenthes Canal and the shrinkage of Mœris Lacus are highly interesting.

The general configuration of this part of the planet underwent no striking changes in 1890. Nepenthes was always double; but the darkness of Libya was occasionally very intense, and, at times, so marked as to "flood" to disappearance Lake Mœris in this sombre background (Fig. 5 of the Plate).

A drawing taken in 1892 by Mr. Walter Gale at Sydney, New South Wales, shows some remarkable changes in the

* It is scarcely likely that it is a matter of mere coincidence that most of our greatest observers of planetary detail, such as Green, Schiaparelli, and Stanley Williams, are all short-sighted men.

Mœris Lacus and Libya regions invaded by the expansion of the Syrtis Major (Plate, Fig. 6).

Finally, in 1894, it would appear that the invasion had actually reached Lake Mœris, which, according to Mr. Lowell, had ceased to exist as a "lake," forming a simple bay of the Hourglass Sea (Plate, Fig. 7). As, however, some observers—amid whom Mr. Stanley Williams, l'Abbé Moreux, and the writer—had distinctly seen this spot at the time, it is more prudent to consider Lake Mœris, or at least its eastern half, free to some extent from the Syrtis Major at the 1894 opposition.

The final disappearance of the lake into the dark material was completed during the last apparition. Libya, as pointed out by Mr. Lowell in 1894, was, after such a protracted obscuration, seen quite clear again in 1896 and 1897. All observers agree on this point. Figs. 8 and 9 of the Plate are among the very latest representations of the Syrtis Major, the former being due to the pencil of the Rev. T. E. R. Phillips—one of the best living observers in England—while the latter is a copy of a drawing taken here in December last with M. Flammarion's nine and three-quarter inch equatorial, power three hundred, and showing a mottled appearance of the surface of the sea, not unlike, perhaps, Prof. Barnard's "mountainous country" of 1894.

Another feature of the 1896-1897 apparition of Mars in the region in question is the formation of a "new" canal, running from the mouth of the ancient Astapus to the Boreosyrtis. This canal was for some time lately an exceedingly obvious marking, and in October, 1896, was darker than the Nilosyrtis. Since then its visibility has gradually decreased. Mr. Lowell's 1894 map shows this feature, and so do some old drawings by Franzenau in 1864, Boeddicker and Burton in 1882. These occasional appearances of the same object make it evident that we have to deal here with some kind of stability, or, rather, with a periodical return to analogous conditions. As much might be said of another canal seen by Mr. Stanley Williams in 1890, uniting Lake Mœris to the Syrtis Minor, which then became invisible for some time and reappeared in 1896.

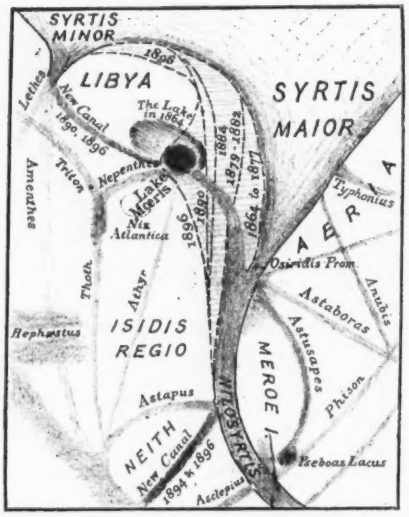

FIG. 10.—Map showing the theatre of the changes in the Hourglass Sea and Libya Regions from 1864 to 1897.

We exhibit in Fig. 10 the result of our discussion of the most trustworthy drawings of Mars made by the best observers of the planet, past or present. The intricate invasion by the dark material of the Syrtis of the bright continent to the east is shown as accurately as possible. But the successive shores of the Syrtis are drawn on the supposition that Lake Mœris has remained fixed in the meantime. Such, however, is not the case; and our impression is *that the lake has advanced towards the sea by a quantity comparable to that by which the Syrtis advanced towards the lake.* The attraction will thus have been mutual.

These displacements of "seas" and "lakes" (or "forests" and "oases"), absurd and imaginary as they might seem to the ordinary reader, are simply familiar occurrences to the areographer. Evidently the surface of Mars has some fixed areographical markings; but the stability of the lesser details and of the polygonations of the canal system is so frail, that at times the changes assume a fantastic, grotesque, and almost ridiculous character.

We will not attempt to explain these extraordinary phenomena, which are besides quite inexplicable by any analogies drawn from our own earth. It would be leaving the solid ground of science for the inextricable maze of conjecture. Vegetation offers no very satisfactory explanation of such appearances, water (inundations, etc.) a positively unsatisfactory one, the occasional formation of cloud over certain regions an untenable one. Perhaps the least improbable—not to say the most plausible—clue to the mystery still attaches to the over bold and almost absurd assumption that what we are witnessing on Mars is the work of rational beings, immeasurably superior to man, and capable of dealing with thousands and thousands of square miles of grey and yellow material with more ease than we can cultivate or destroy vegetation in a garden one acre in extent.

THE LANGUAGE OF SHAKESPEARE'S GREENWOOD.—II.

By GEORGE MORLEY, *Author of "Leafy Warwickshire," "In Rustic Livery," "Sweet Audrey," "In Russet Mantle Clad," etc.*

IN the core of nature's heart, words that come "trippingly from the tongue," as Hamlet would say, are those most in use with the rustic. A desire for condensation and abbreviation is also apparent. The peasant will say, "Adone, will ye?" meaning "Have done," thus merging two English words in one. When the Bidford Audrey or Phyllis is troubled in love affairs the fond mother will say, "Hey, lassie! adone wi' it, or I shanna catch a blench on thy eye no-ways. Now do adone."

"A blench" is a term conveying an enigma to the townsman in the sense in which the rustic uses it. To the townsman "a blench" would seem to imply a sudden whiteness or pallor of the countenance, as a blanching of the face. In the dialect of the Warwickshire peasant it has a totally different signification. "A blench" means a glimpse, a glance, a look. A greenwood maiden gives her lover "a blench on her bonnie eye"; a gamekeeper catches "a blench" or a glimpse of the poacher setting his nets in forbidden preserves; and Grandfer William takes a good "blench" at the smart coaching party dashing gaily through his Sleepy Hollow.

In the word "on," used in place of "of," we catch what I may call "a blench" of Shakespeare's application of his homely mother tongue.

"We are such stuff
As dreams are made *on*,"

says the immortal Warwickshire poet in "The Tempest" (Act IV., Scene 1); and in more than three centuries from the date of that play the peasant of Shakespeare's greenwood may be heard saying, "That dream as I telled thee *on* as my butty had," or "A man as I knows *on*." With the rural dweller in this delightful county it is always "on" and never "of"; and if the truth must be said, it

really does give a quaint and picturesque force to the speaking of a sentence.

In the language of the isolated dwellers in these solitary nooks of leafy nature, there are sundry dialect words used in a friendly and companionable sense. The word "wench" is one of these. This is applied distinctively to females of whatever kind, calling, condition, or rank. In a similar sense the word used towards males is "butty." It means a friend, a companion, a mate, and sometimes something more, for it is not infrequently that a village lass will, in a merry mood, call her sweetheart her "butty." Strictly, however, the word is the property of the male. It is addressed both to human and animal friends. The poacher's human companion on his nightly prowls is always his "butty," and the shepherd will address his dog as follows: "Hey, bless his four paws! he's a dear old butty; aye, an' a goodly."

It has been said that the language of the Warwickshire greenwood is more akin to the language of Shakespeare and the Bible than any other English dialect. Certainly it has the simplicity, the directness, and the force both of the Bible and Shakespeare. This fact can be well seen in the word "cumber," so frequently heard in the mouth of the Warwickshire peasant. "Ah! the cumber that I had wi' that lad!" cries the mother in despair for the well-being of her son. "Cumber" means trouble, burden, weight, and care. George Eliot alludes to it in "Adam Bede" (Chapter XXVI., p. 241), where Lisbeth speaks to her son, Adam: "I know it's a grit honour for thee to be so looked on—an' who's to be prouder on it nor thy mother? Hadna she the cumber o' rearin' thee an' doin' for thee all these years?"

In the Biblical story of the barren fig tree the meaning of "cumber" is precisely the same as its significance to-day. The fig tree cumbered the ground; in other words, troubled and burdened the ground with a great care, like the rearing of children, which, in the opinion of some Warwickshire housewives and mothers, is a thankless and barren office.

Other words there are in constant vogue of a kindred meaning. One of these is "moither." No peasant of Shakespeare's greenwood, in a certain condition of mind, ever fails to make use of this word. "Adone, I tell thee; ye moither me to death!" cries the mother to the hardy rustic lad who persists in importuning for a holiday. To "moither" is to worry, to bother, to bewilder. This word is indigenous to urban as well as rural Warwickshire, and it may even be heard in the mouth of a fair huntress rebuking her horse: "Be quiet, sir, and don't moither me so."

"Mummock" is a curious word in the same category. A baby "mummocks" its mother—that is, bothers her, worries her, pulls her about. Often in the silence of these leafy lanes the voice of the rustic may be heard screaming through a cottage door in far from dulcet or kindly tones, "Adone, ye lil mummock! ye moither me above a bit!" In another sense, "mummock" expresses sorrow and mourning, as, "I shall just mummock mesel' into me grave when thee'st gone from me." The nightingale "mummocks" or mourns for the eggs of which she has been robbed, and so on; as an expression of sorrow, "mummock" is used throughout the range of living things, whether of the human, brute, or bird creation.

In continuation of the set of words denoting worry or expressing sorrow, I may instance the truly Shakespearean word "moil." "The moil of this life pulls me down to the ground," sighs the weary villager, seeing his labour come to naught; and the sentence clearly brings out the real meaning of the word. "Moil," in its practical sense, is but another name for toil. It simply means labour, hard work, drudgery, care, and trouble.

In the course of her laundry work the Warwickshire village housewife may be heard calling out, "You mun give me the batlet; I canna do wi'outen she." Now, the word "batlet" is direct from Shakespeare. In "As You Like It" (Act II., Scene 4) Touchstone says, with a pretty sense of the foolishness of a lover, "And I remember the kissing of her batlet"—the batlet that the pleasing Jane Smile had used in her washing.

The "batlet" of Shakespeare is the "dolly" of the modern housewife—a wooden bat or machine for beating or dollying the family linen. It was also known as "the maiden," by which name it is dignified to-day by many of the homely women of rural Warwickshire.

A townsman wandering down some of the more isolated lanes of the leafy shire in the evening of the day, may often hear a parent calling to her child, "Come thee in, little dillin'. The dag's fallin', an' thee hanna no hat on thy yed." Now that word "dag" is one of the picturesque peculiarities of the Warwickshire rural dialect. It means dew, moisture, or fine rain. The old weatherworn shepherd of any farm is anxious to in-barn his young eanlings "afore the dag comes on"; the watchful mother, both morning and evening, will place a "biggen," or cap, upon the youngest born, "to keep the dag off on thee." My old friend Amos Oates, the shepherd of the Combe Farm, has often, in the early hours of the morning, addressed to me the words: "It be as heavy a dag, sir, this mornin' as I 'ood wish to see afore Marti'mas Day—so it be." Though some peasants do say "dew," the majority always use "dag."

As an example of the apparent kinship of some of the words in the Warwickshire dialect with the words to be found in the English Bible, I may instance the word "anointed." The peculiar significance of this word lies in the fact that it has an evil rather than a good interpretation. The woodland peasant boy who has been so unlucky as to incur the displeasure of an elder, is "an anointed young scaramouch, folly-fit for Old Harry"; that is to say, the lad is "anointed" with the oil of wickedness: is, in fact, a very wicked boy indeed.

So glib has this word become in the mouth of the peasant that everybody or everything that has done what is considered to be wrong is assailed with the word "anointed."

In another and more endearing sense is to be noted the epithet "cade." This is a well-known Warwickshire word, peculiar, I believe, to Shakespeare's greenwood. "Cade" is the rustic's pet name for anything that is tame, mild, or gentle. The lamb, for example, that has been reared in the homestead by bottle through loss of its dam, is "as cade as cade"—that is to say, as tame and gentle as could be. When the colt has been roughridden and broken to harness, then "she be cade as a kitten." Everything that is meek and mild of bird and beast is a "cade" thing. The term is also used by the young men to their lasses. Whenever a rustic damsel is more than usually dainty and gentle she is called "a pretty cade Jill."

I have heard the dialect of the Warwickshire rustic spoken of as being "very broad." Certainly there are words in the tongue which might come within the range of that definition, but they are in a minority. When you meet a jaded peasant woman in a narrow lane—"a chewer," as she would call it—resting after what, perhaps, has been a hard journey, and she tells you that she is "fore-wearied wi' her jaunt," I think you may honestly say that the language is poetical. To be "fore-wearied" is to be very weary, very tired—in fact, dead-beat. Shakespeare has

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not missed this poetical term. In "King John" (Act II., Scene 1) he speaks of—

"This 'fore-wearied' flesh."

One of the "broad" uses of the mother tongue is the sounding of the letter "o" as if it were "w." This truly is a broad and curious characteristic, and really comes somewhat harshly upon the ear of those in search of the expressive and picturesque in diction. The harvester I sometimes meet in the neighbourhood of the Red House Farm at Lillington, astonished me one hot summer day by saying: "Hey, the weather's uncommon—uncommon it be. The *wuts* be a'most ready for the blade now." Oats are "wuts" in the dialect of the Warwickshire peasant, and in this and similar uses of the "w" for "o," he betrays that broadness of speech which is the one blemish upon his simple, direct, and entertaining tongue.

As an illustration of the wealth of curiosities studding this interesting language, mention may be made of the original additions which the uncultured peasant tacks on to the orthography of his native greenwood. This is one of the most amusing, and, at the same time, stedfast features of the Warwickshire rural dialect. I allude to the permanent addition of "n" to many of the words in use by the rustic. As countrymen of a genius in the art of dialectical expression, the peasantry of Shakespeare's greenwood are not content to say "his"; with them it is always "hisn." This peculiarity proceeds through quite a range of familiar terms. "That be a nice row of housen," is Strephon's way of saying "That is a nice row of houses." In like manner, "ours" is "ourn" with him, "yours" is "yourn," "hers" is "hern," "theirs" is "theirn," and so on; making the language quite original in its grip and quaintness.

A similar perversion of the letters of the alphabet is to be seen in the rural substitution of "y" for "h" or "i." This has a striking effect, as anyone who has been amongst the Warwickshire rustics can readily testify. To hear a man who has been accidentally struck on the head by a fellow worker crying out, "Come, butty! my yed yent 'ard enough for that sort o' game, ye know," when he means that his "head is not," is very quaint and amusing indeed. Nearly every Warwickshire rustic, devoted to his own rood of native earth, or migrating to "fresh woods and pastures new," uses the word "yent" for is not, and "yed" for "head." With him, too, are such pronounced peculiarities of speech as "wevver" for "however," and "yarbs" for "herbs"; as, "Ye hev a good bed o' yarbs there, yent ye?" In this sense "yent" stands for "haven't" or "have not."

As might readily be imagined, bearing in mind the isolated and lonely nature of some portions of Shakespeare's greenwood, the word "unked" is constantly heard. Speaking of a certain farm, my shepherd friend one day said to me, "'Tis a martal unked place, I can tell thee; there's 'ardly a cow's yed on't, so you can tell." In rural Warwickshire this word "unked" is used in a variety of ways. It is applied to person, animal, place, or thing. One meaning of the term is lonely, dull, solitary; as, for instance, "I feel very unked wi' nobody to speak to." Another applies to sights and scenes. A maiden will say, "Oh, but I had such a unked dream last night." In fact, the general significance of the word seems to be that anything of an unpleasing nature to the sight, or affecting the well-being of the person, is "unked" in the understanding of these picturesque woodlanders.

The what I may call poetic touch in the language of Shakespeare's greenwood is very happily seen in the word "favours." No true peasant of leafy Warwickshire ever neglects the use of this pretty word. Whenever two mothers are discussing the comeliness of a child at the garden gate of their cottage, one of them is sure to say, "I think she favours her father." To "favour" is to look like, to resemble. "'Tis said as I favour you, mother, more nor father," a fond daughter will cry with delight, her mother being pretty; and in like manner the shepherd, after tracing the lineaments of a lamb, will sagely remark, "I judge as her favours her dam."

That word "judge," too, so extensively used by the peasantry, has quite a Shakespearean ring about it. What, for example, could be prettier than the expression of an aged parent to her newly assembled children: "God bless all on ye; I judged ye'd be coming to see me this motherin'"—meaning "I thought you would." In another way "judge" is used as an accusation, as, "I judge ye o' havin' telled that lie." To "judge" literally means to think or to accuse, and the sense in which it is uttered has quite a charm as it issues from the rustic's tongue.

These are a few selections of the principal characteristics peculiar to the language of Shakespeare's greenwood. They have been taken at random with a view to making these two papers both interesting and informing; but they will suffice, I think, to clearly evince the grip, the directness, and the picturesque quality of the dialect of this woody and classical county. There are few tongues so exclusive, and so little prone to change, as the tongue of the Warwickshire peasant; and yet, as I have pointed out, this county, well called (Drayton)

"The heart of England,"

is, perhaps, more assailed by the influences of modern change than many other shires not so frequently visited.

Living so far in the core of nature's heart, it may be that the rustic of Shakespeare's greenwood has become what Gilbert White of Selborne would call "a stationary man," devoted alike to his language and his soil. Certain it is that the homely, direct speech written more than three centuries ago by the great dramatist of Stratford-on-Avon, is practically the same as the peasantry speak to-day.

And the manners, moreover, are much the same, as I will show by one single illustration. Human nature being nearly akin in any time, clime, or under any condition, it is, perhaps, by no means remarkable that sometimes the Warwickshire lasses will fall out with one another, and eventually wage war. In such a case, one of the girls—or both—is almost sure to say, "I'll set my ten commandments in your face!" which, in more vulgar language, means, "I'll scratch your face with my ten nails." This remark is directly conveyed from Shakespeare, to whom this country and all the world owe so much, for in the Second Part of "King Henry VI." (Act I., Scene 3) occurs the following couplet:

"Could I come near your beauty with my nails,
I'd set my ten commandments in your face"—

a very expressive example, indeed, of the language of Shakespeare's greenwood.

THE FACE OF THE SKY FOR JULY.

By HERBERT SADLER, F.R.A.S.

THERE will be an annular eclipse of the Sun on the **29th**, quite invisible in Europe.

Mercury is not well situated for observation this month. On the **1st** he rises about a quarter to three A.M., or about one hour before the Sun, with a northern declination at noon of 22° 35′, and an apparent diameter of 6″. Shortly after this he approaches the Sun too closely to be visible, being in superior conjunction with him on the **15th**. He is an evening star towards the end of the month, but is still too close to the Sun to be visible.

Venus is a morning star, and, as such, is excellently placed for observation, being at her greatest western elongation (46°) on the **7th**. On the **1st** she rises at 1h. 27m. A.M., or nearly two and a quarter hours before the Sun, with a northern declination of 15° 35′, and an apparent diameter of 25½″. On the **10th** she rises at 1h. 15m. A.M., or about two and three-quarter hours before the Sun, with a northern declination of 17° 28′, and an apparent diameter of 23″, about half her disc being illuminated. On the **20th** she rises at 1h. 4m. A.M., or 3h. 5m. before the Sun, with a northern declination of 19° 20′, and an apparent diameter of 21″. On the **30th** she rises at 1h. A.M., or 3h. 20m. before the Sun, with a northern declination of 20° 46′, and an apparent diameter of 19″. She is in conjunction with Ceres at 2h. A.M. on the **23rd**, Ceres being 6′ south; and with Neptune on the morning of the **28th**. During July Venus pursues a direct path through nearly the whole length of Taurus.

Mars is for all practical purposes invisible, his diameter being so small, and the planet setting so soon after the Sun.

Jupiter can be seen during July, but cannot be said, owing to his proximity to the Sun, to be in a favourable position for observation. On the **1st** he sets at 10h. 50m. P.M., or about two and a half hours after the Sun, with a northern declination of 10° 18′, and an apparent equatorial diameter of 33¾″. On the **10th** he sets at about a quarter past ten P.M., with a northern declination of 9° 43′, and an apparent diameter of 33¼″. On the **20th** he sets at 9h. 40m. P.M., or about one and a half hours after the Sun, with a northern declination of 9° 2′, and an apparent diameter of 32¾″. After this he approaches the Sun too closely to be visible. He describes a short direct path in Leo.

Saturn is an evening star, but his low declination militates strongly against accurate observation of the details on his surface. On the **1st** he rises at 4h. 15m. P.M., with a southern declination of 16° 50′, and an apparent equatorial diameter of 17½″ (the major axis of the ring system being 41¾″ in diameter, and the minor 16¾″). On the **10th** he rises at 3h. 40m. P.M., with a southern delcination of 16° 48′, and an apparent equatorial diameter of 17½″. On the **20th** he sets at 0h. 13m. A.M., with a southern declination of 16° 47′, and an apparent equatorial diameter of 17¼″. On the **31st** he sets at 11h. 26m. P.M., with a southern declination of 16° 49′, and an apparent equatorial diameter of 17″. During the greater part of July he pursues a very short direct path in Libra, being stationary on the **28th**.

Uranus is an evening star, but is very badly situated for observation, owing to his great southern declination. On the **1st** he rises at 4h. 30m. P.M., with a southern declination of 18° 55′, and an apparent diameter of 3·7″. On the **31st** he sets at 11h. 14m. P.M., with a southern declination of 18° 55′. During the month he describes a short retrograde path in Libra.

Neptune is, for the purposes of the amateur observer, practically invisible.

Shooting stars are fairly numerous in July, but twilight interferes with observation. There is a well-marked shower near δ Aquarii towards the end of the month, the maximum being on the **28th**. The radiant point is in R.A. 22h. 40m., south declination 13°.

The Moon enters her first quarter at 1h. 32m. P.M. on the **7th**; is full at 4h. 52m. A.M. on the **14th**; enters her last quarter at 3h. 8m. P.M. on the **21st**; and is new at 3h. 58m. P.M. on the **29th**. Many of the stars in the Pleiades will be occulted on the early morning of the **24th**.

Chess Column.

By C. D. LOCOCK, B.A.Oxon.

Communications for this column should be addressed to C. D. LOCOCK, Burwash, Sussex, and posted on or before the 10th of each month.

Solutions of June Problems.

(T. Raddick.)

No. 1.

1. R to QB3, and mates next move.

No. 2.

Key-move.—1. R to Qsq.

If 1. . . . K to B3. 2. R to Q4, etc. (or B to Kt6, dual).
1. . . . K × P. 2. B to Kt6ch, etc.

[We regret that the number of moves was accidentally omitted. Fortunately most of our solvers found no difficulty in supplying the omission.]

CORRECT SOLUTIONS of both problems received from Capt. Forde, Alpha (not correct in one variation of No. 2), Novice, J. T. Blakemore, G. G. Beazley, H. le Jeune, E. W. Brook.

Of No. 1 only from H. S. Brandreth, J. M'Robert, W. Clugston, W. H. Lunn, and one unsigned (Hornsey).

W. Clugston.—Many thanks for letter and enclosures. Of your earlier received problems we much prefer No. 34, printed below. In the "crowd" of No. 33, is not the P at B2 useless, as 1. B to Ktsq would not solve the problem?

H. D'O. Bernard.—Your four-mover is demolished by 1. RR6ch, followed by BB3 or KKt7 accordingly. With a Black King so surrounded it will be a difficult matter to make the problem sound.

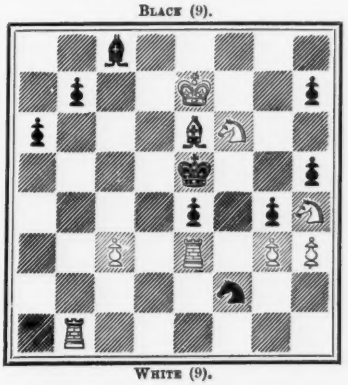
J. H. Ballantine.—Have you noticed that your key-move which has the defect of guarding the Black King's sole exit, threatens both B to Q5ch and R × Rch, the result being innumerable duals? Also the White QB seems unnecessary. We should be glad to receive an amended version, as the position seems capable of being made into a fine problem.

PROBLEMS.

No. 1.

By W. Clugston.

BLACK (9).



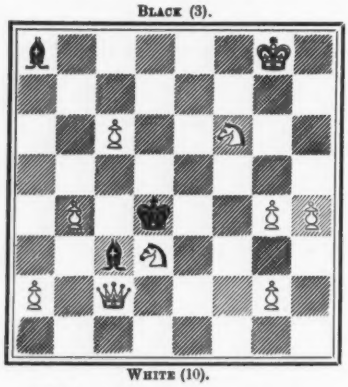
WHITE (9).

White mates in two moves.

No. 2.

By A. C. Challenger.

BLACK (3).



WHITE (10).

White mates in three moves.

CHESS INTELLIGENCE.

The cable match between the House of Commons and the U.S.A. Congress terminated, after a contest full of incidents, in a tie. But for the courtesy of Mr. Atherley Jones's opponent, who refused to claim a game by the time-limit, and ultimately lost it, the Americans would have won the match by 3½ to 1½. Mr. Plunkett, a former president of the Oxford University Club, was by far the strongest player in either team. The presence of Sir G. Newnes, had he been eligible, would have strengthened the House of Commons team. The following was the score :—

England.			America.	
1. Right Hon. H. Plunkett	1	v.	Hon. Mr. Pearson	0
2. Mr. J. H. Parnell	0	v.	Hon. Mr. Shaforth	1
3. Mr. Strauss	0	v.	Hon. Mr. Bodine	1
4. Mr. Atherley Jones	1	v.	Hon. Mr. Plowman	0
5. Mr. F. W. Wilson	½	v.	Hon. Mr. Handy	½

By the death of the Earl of Dartrey, in his eightieth year, the St. George's Chess Club has lost its president of more than forty years' standing. As Viscount Cremorne he was well known as a very strong amateur player.

Mr. Teichmann won his match with Mr. H. H. Cole in the most decisive manner by five games to none, without even a single draw. Mr. H. Jacobs has defeated Mr. Trenchard by five games to three, with three games drawn.

Subjoined is the thirteenth game of the Schiffers-Tchigorin match :—

WHITE. (E. Schiffers.)	BLACK. (M. Tchigorin).
1. P to K4	1. P to K4
2. Kt to KB3	2. P to KB3 (?)
3. Kt×P	3. Q to K2
4. Kt to KB3	4. P to Q4
5. P to Q3	5. P×P
6. P×P	6. Q×Pch
7. B to K2	7. Kt to B3
8. Castles	8. B to Q2
9. Kt to B3	9. Q to Kt3 (*a*)
10. Kt to K5 (!)	10. Kt×Kt
11. B to R5	11. Castles
12. B×Q	12. P×B
13. Q to K2	13. B to Q3
14. Kt to K4 (*b*)	14. Kt to B6ch
15. P×Kt	15. B×Pch
16. K to Kt2	16. B to R6ch
17. K to Rsq	17. B to K4 (!)
18. K to Ktsq	18. B to R7ch
19. K to Rsq	19. B to K4
20. Q to Ksq	20. B to Kt5 dis ch (!)
21. K to Ktsq	21. B×BP
22. Kt to Kt3	22. Kt to K2
23. Q to K3	23. B to B3
24. Q×RP (*c*)	24. P to Kt3 (*d*)

NOTES.

(*a*) This loses the Queen, but Black has a bad game anyhow.

(*b*) 14. B to B4 would have made all safe. M. Tchigorin takes full advantage of the mistake.

(*c*) Probably in order to give up the Queen for the Rook should Black reply B to Q5.

(*d*) As pointed out in a contemporary, Black must have been so absorbed in constructing a combination for the draw that he overlooked a splendid win here by 24. (instead of P to Kt3) R to R8ch. 25. Kt×R, B to R7ch. 26. K×B, R to R1ch. 27. K to Kt3, Kt to B4ch. 28. K to B4 or Kt4, R to R5 mate. As it was, Black succeeded in drawing the game by perpetual check.

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